

ELECTRICAL REVIEW

FRIDAY
3 FEBRUARY 1961

WEEKLY
PRICE 1s 6d



Why 4 out of 5 women go for **Mazda** **Netabulb**

4 out of 5 women prefer a smaller bulb that has a neater, trimmer shape.

They go for NETABULB

4 out of 5 women like a bulb that's snug in the smaller modern fittings.

They go for NETABULB

4 out of 5 women prefer a bulb whose whiter light is kinder to the eyes.

They go for NETABULB

Mazda lamps stay brighter longer

A.E.I LAMP AND LIGHTING CO. LTD.



BICC

**PLASTIC
MAINS
CABLES**

**with shaped
conductors**

for economy

*Further information
in Publication No. 438
is available on request*

BRITISH INSULATED CALLENDER'S CABLES LIMITED, 21 Bloomsbury Street, London W.C.1

PROVEN EFFICIENCY IN A NEW SETTING

Cistern Type FB (FLAT)

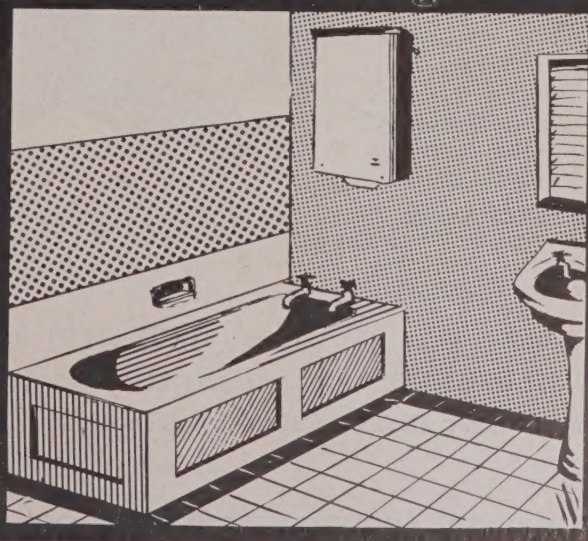
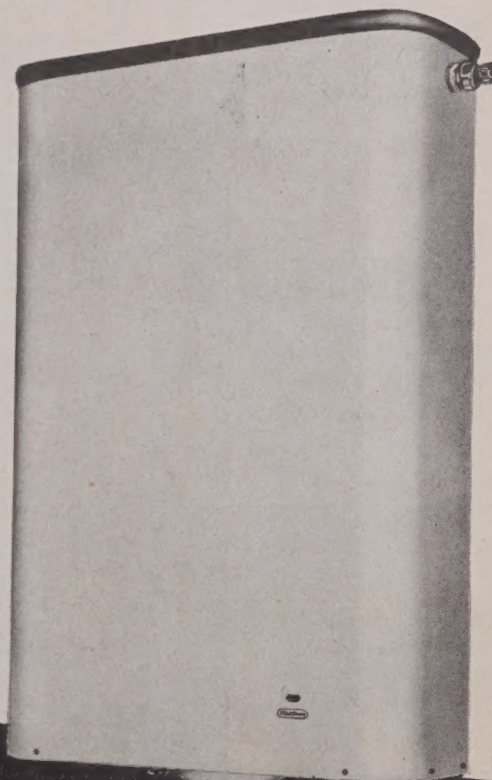
Automatic Control ELECTRIC WATER HEATER

In keeping with modern trends, this ever popular heater has now been restyled to give even cleaner, more attractive lines than hitherto.

Essentially for wall fixing, the FB is
A COMPLETE MULTI-POINT HOT WATER SYSTEM
containing its own ball valve, cistern and expansion pipe and overflow and hot water outlet connections.

The heater works on the constant volume variable temperature principle — a complete hot water system in itself, only requiring to be connected to a cold water feed and suitable electrical point.

Capacities (gallons):...	5	12	15
Loadings:.....	3 kW	3 kW	3 kW
Voltage range:.....	200-220 or 230-250 Volts.		



HEATRAE LTD

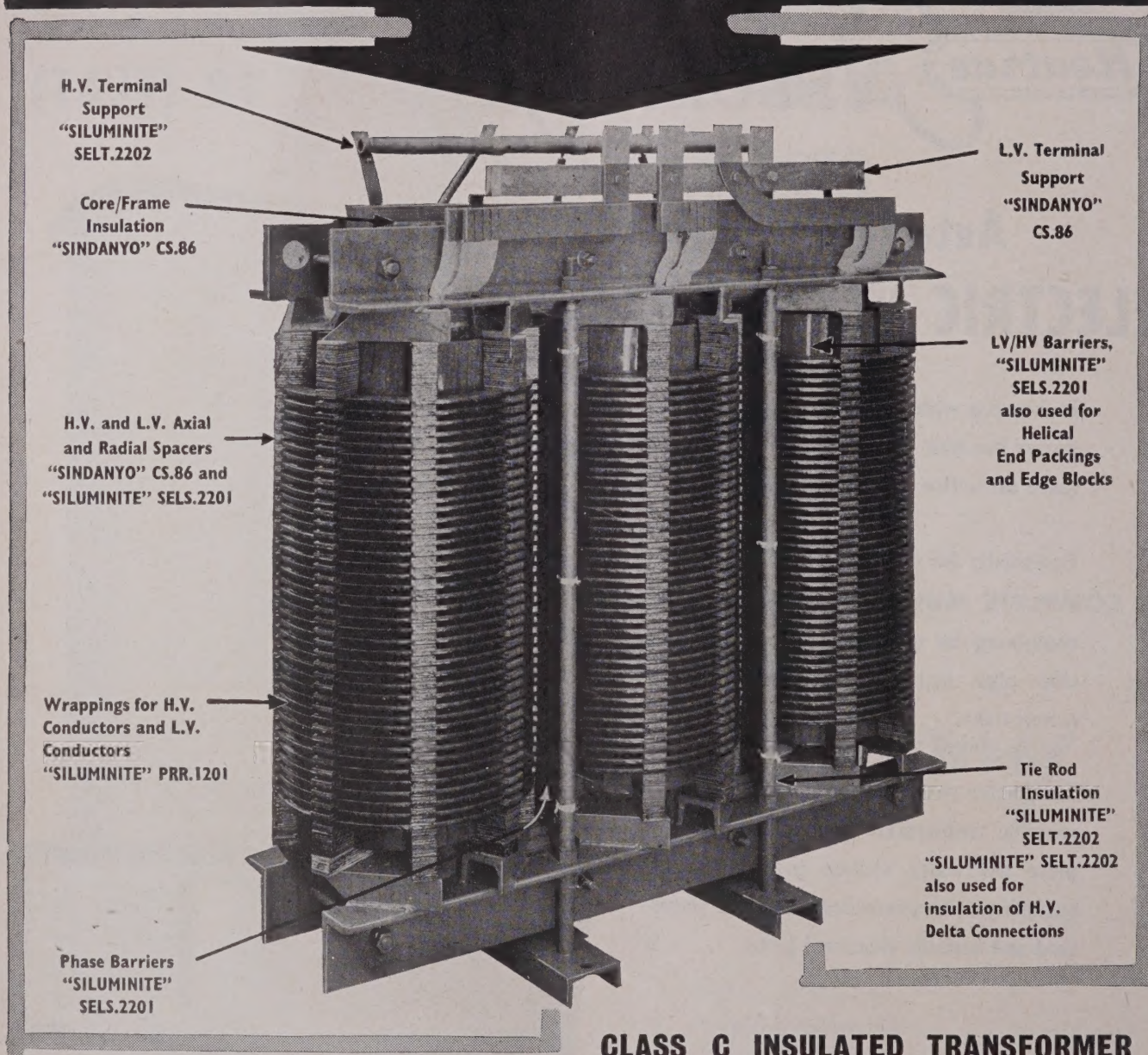
NORWICH - NORFOLK - NOR 29A - ENGLAND

Telephone: NORWICH 25131

Telegrams: HEATRAE NORWICH

• Please write for Leaflet 101

ASBESTOS for CLASS H and CLASS C INSULATION FOR DRY TYPE TRANSFORMERS and SIMILAR APPLICATIONS



CLASS C INSULATED TRANSFORMER 500-kVA 3 PHASE 11,000/433V

Information on the various "SINDANYO" and "SILUMINITE" products may be obtained by application to the Electrical Insulation Department.

Manufactured by Associated Electrical Industries Ltd., using:- Asbestos based insulating materials supplied by Turners Asbestos Cement Co. Ltd.
(By courtesy of Associated Electrical Industries Ltd.)

TURNERS ASBESTOS CEMENT CO. LTD., TRAFFORD PARK, MANCHESTER 17

A MEMBER OF THE TURNER & NEWALL ORGANISATION

Telephone: TRAFFORD Park 2181

London Office: EVERITE HOUSE, SOUTHWARK ST., S.E.1. Telephone: WATERloo 4712

Birmingham Office: Union Chambers, 63 TEMPLE ROW. Telephone: MIDland 0244

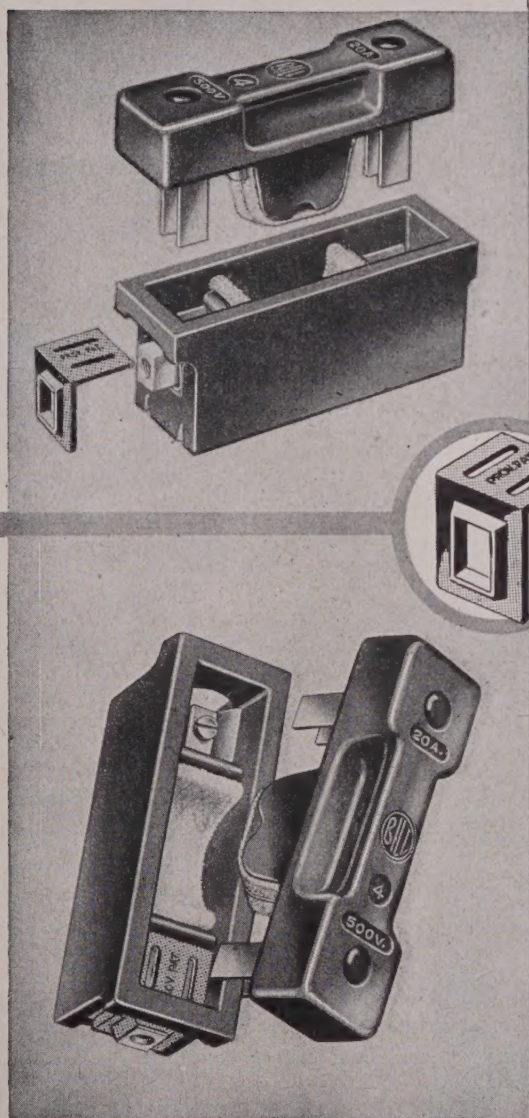


You cannot buy better gear

SAFETY

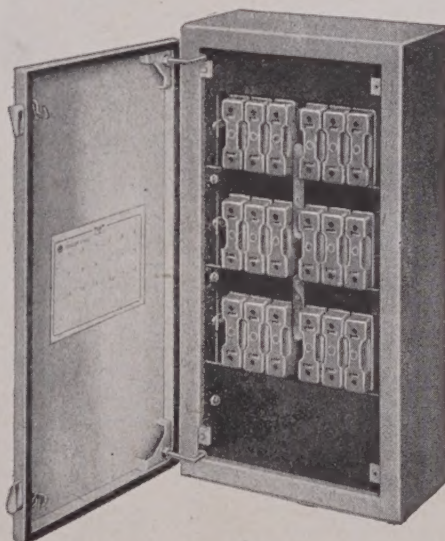


SHIELDS



BILL ARC DAMPING TYPE OR H.R.C. DISTRIBUTION FUSEBOARDS ARE NOW FITTED WITH THE **BILL** SAFETY SHIELDS (PROV. PAT.) AS ILLUSTRATED.

FUSEBOARDS ARE AVAILABLE WITH NO PRICE INCREASE IN ALL SIZES OF 15/20 AMP. AND 30 AMP. RATINGS.



THE INTRODUCTION OF PROTECTIVE SHIELDS FITTED OVER THE LIVE CONTACT ENDS IN THE FUSE BASES GIVES ADEQUATE PROTECTION AGAINST ACCIDENTAL CONTACT WHEN THE FUSE CARRIERS ARE WITHDRAWN.

THE SHIELDS ARE STRONG DURABLE MOULDED NYLON AND FORM AN INTEGRAL PART OF THE BUSBAR FUSE CONTACT ASSEMBLY AND CANNOT ACCIDENTALLY BECOME DETACHED.

BILL SWITCHGEAR LTD
BIRMINGHAM-20

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R. W. HANKINSON
GILLINGHAM ST.

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J. A. PEARCE,
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BRISTOL, 3
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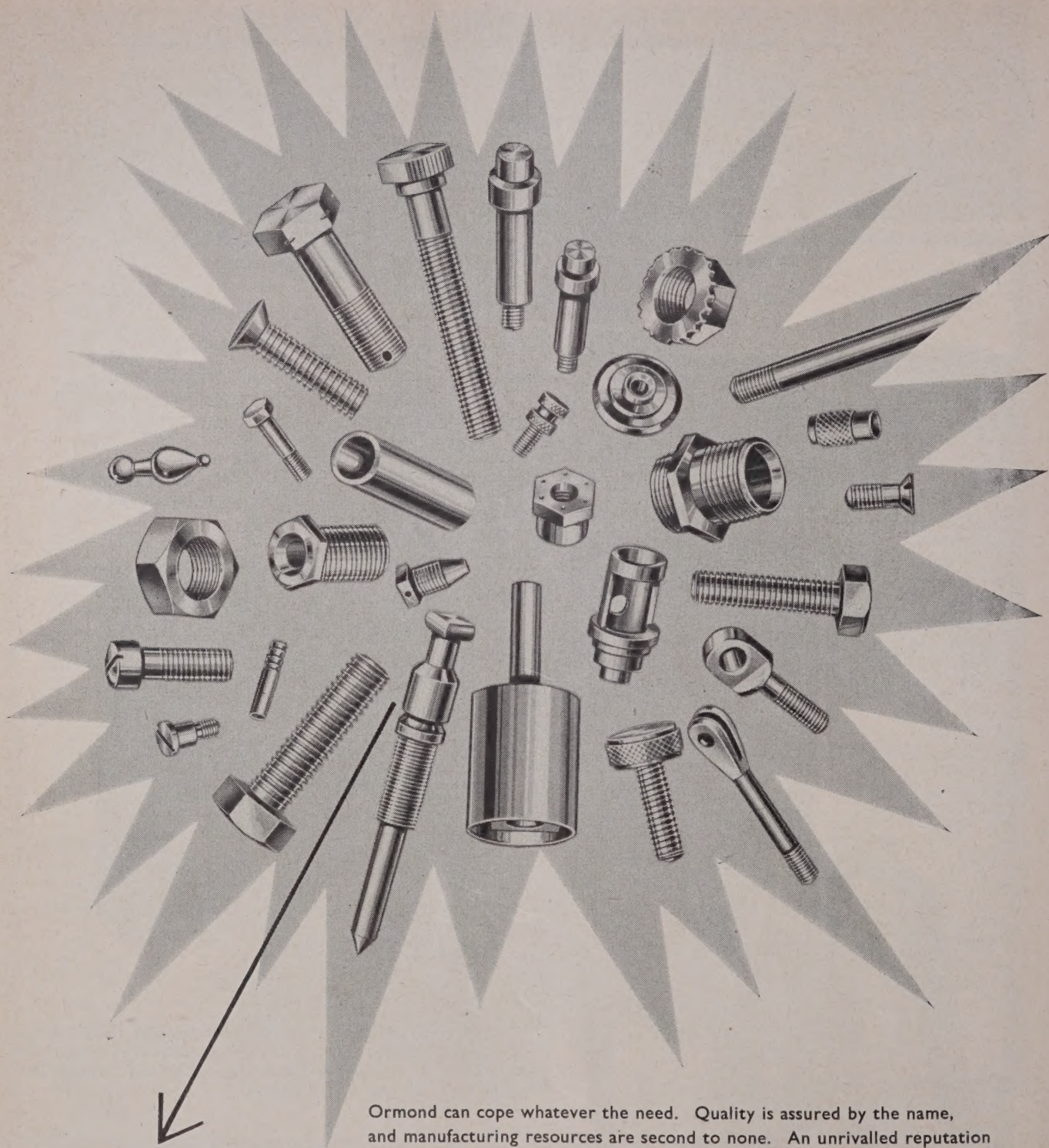
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G. SUTTON,
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CHELTEMHAM
C. GEARING,
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MANCHESTER 3
H. H. POLLARD,
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Repetition work

Ormond can cope whatever the need. Quality is assured by the name, and manufacturing resources are second to none. An unrivalled reputation for service takes care of prompt delivery. Please ask us to quote. Any quantity.

The Repetition Parts range covers single and multi spindle automatics up to 1½" dia., Brass, Steel and Light Alloy Screws in Rolled and Cut Threads, Grubscrews, Nuts, Allthreads, Hexagon Bolts and Setscrews turned from bar and Cold Headed Grades "A", "B", and High Tensile.



THE ORMOND ENGINEERING CO. LIMITED

Ormond House, Rosebery Avenue, London, E.C.1

Telephone: TERminus 2888

Telegrams: "Ormondengi, Cent"

Self-contained variable-speed THREE-PHASE A.C. MOTORS

IMPORTANT ADVANTAGES

Speed

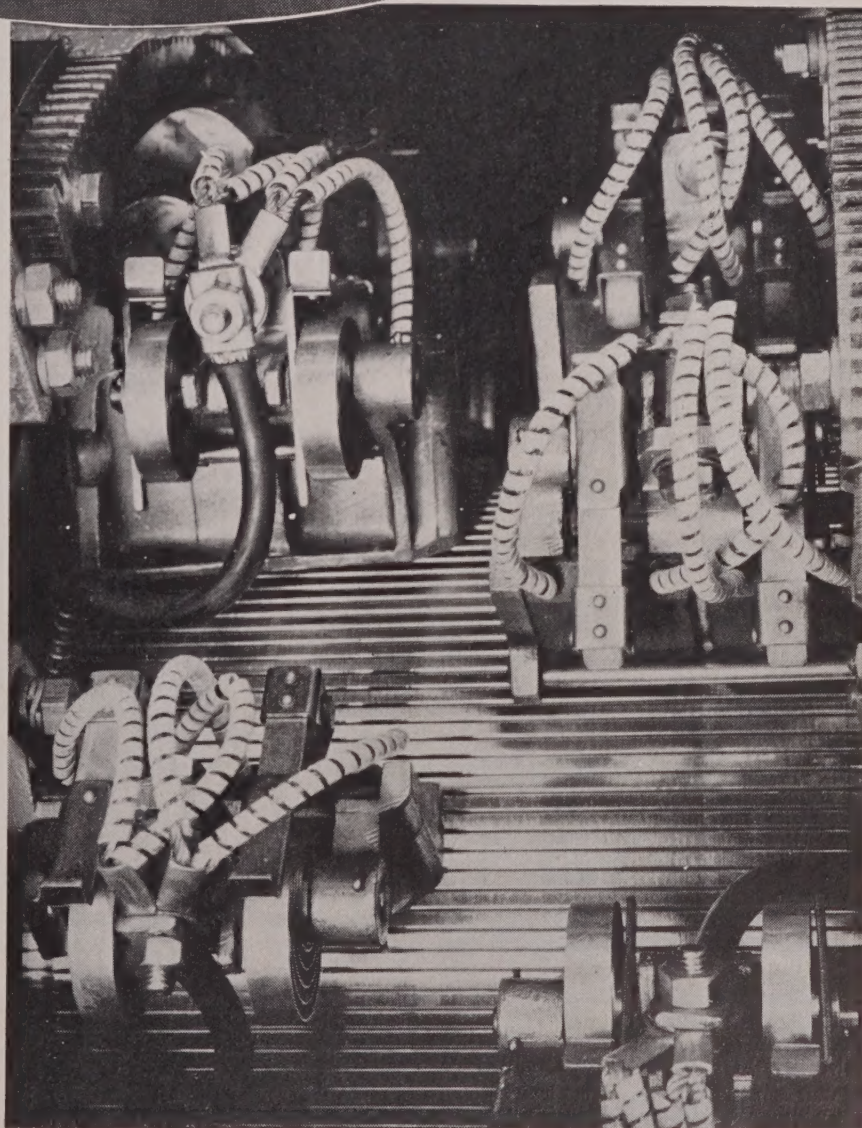
Stepless variation, with unlimited speed ratios. No external regulator. Wide speed range, with reverse operation when required. Speed variation may be by hand, remote or servo control.

High Performance

Good shunt characteristics at all speeds, whether motoring or generating. High efficiency and power factor throughout top half of speed range. High starting torque with low starting current.

Good Delivery

Motors between 30 and 100 h.p. are built from stock parts ensuring short delivery times.



Write for further information to:

(FOR MOTORS UP TO 30 H.P.)
Small Industrial Machines Sales,
Motor & Control Gear Division.
BLACKHEATH, STAFFS.

(FOR MOTORS ABOVE 30 H.P.)
Medium Electrical Machine Sales,
Heavy Plant Division,
RUGBY.

AEI

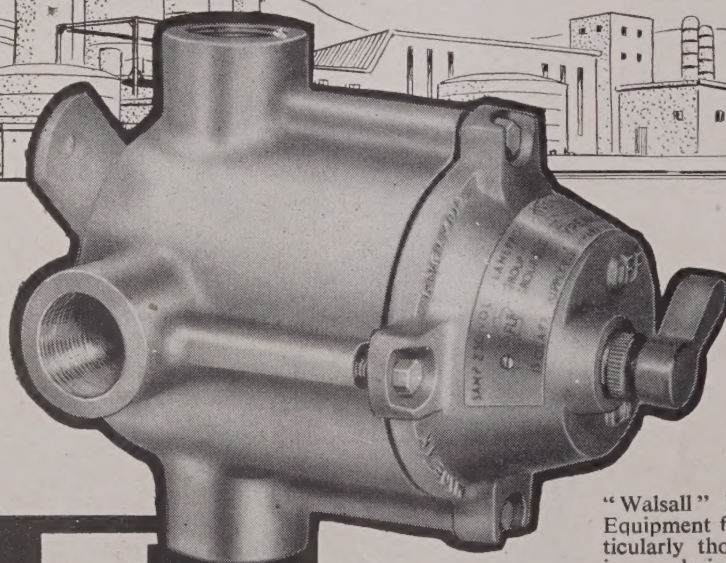
Associated Electrical Industries Limited

FLAMEPROOF



AND NOW WEATHERPROOF

Circular Switches



"Walsall" Buxton Certified Flameproof Equipment for Electrical Installations, particularly those in the Petroleum Industry is now designed to meet weatherproof conditions viz: "the apparatus is so constructed that it is suitable for operation under specified weather conditions without further protection."

FLAMEPROOF/WEATHERPROOF CIRCULAR SWITCHES
 BUXTON CERTIFIED Groups I, II, & IIIa & IIIb.
 FLP. 4466 & 7—PATENT APPLIED FOR.
 5 AMP 250 VOLTS—Single or Double Pole.

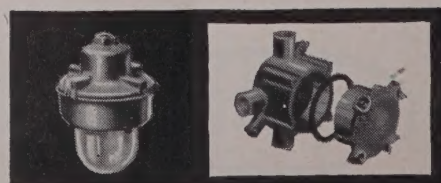
The unit consists of a heavy cast iron case having a machined spigot joint with cover, between which is a "Neoprene" packing washer, the whole providing a Flameproof and Weatherproof joint. The cover is secured by 4 shrouded head bolts to prevent unauthorised removal. The switch movement is mounted on a patented insulating plug, which is easily removable for quick wiring.

FURTHER FLAMEPROOF/WEATHER-PROOF UNITS AVAILABLE

WELL GLASS LIGHTING FITTINGS
 40, 60 or 100 Watt
 BUXTON CERTIFIED Groups II, IIIa & IIIb
 CONDUIT JUNCTION BOXES
 BUXTON CERTIFIED Groups II, IIIa & IIIb

WALSALL CONDUITS LIMITED

EXCELSIOR WORKS • WEST BROMWICH



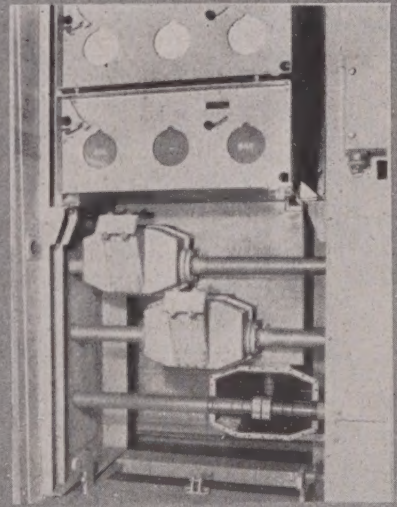
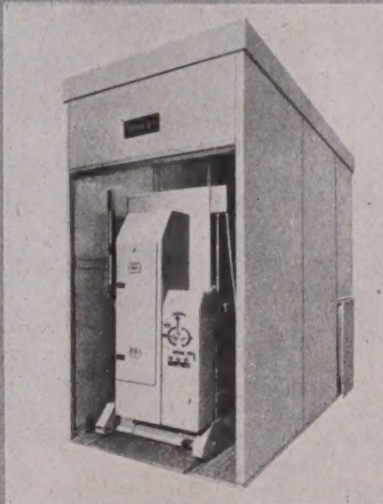
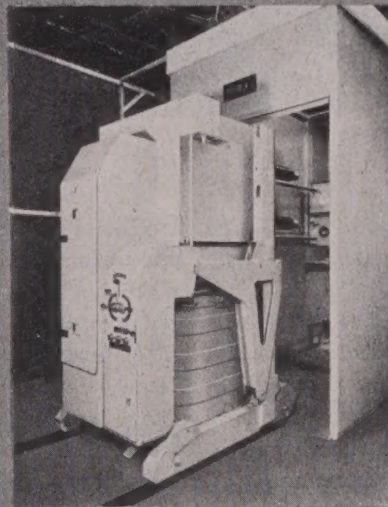
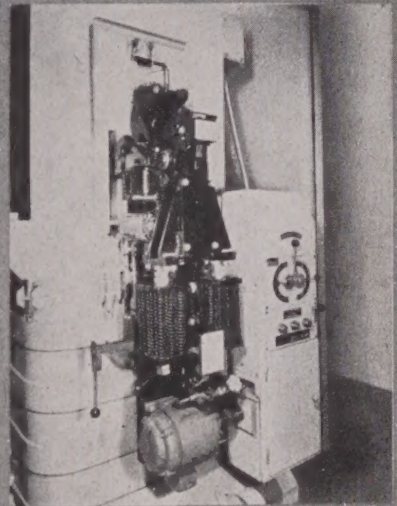
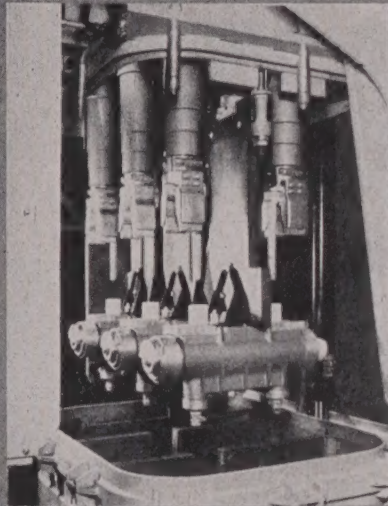
HI-VE 18 **33kV** OUTDOOR METALCLAD SWITCHGEAR

OUTSTANDING HIGH-PERFORMANCE
1,000 MVA O.C.B.

ADVANCED DESIGN FEATURES

HYDRAULICALLY ACTUATED O.C.B.
CLOSING MECHANISM.

FULL MAINTENANCE POSSIBLE WITHIN
OUTDOOR HOUSING.



O.C.B. /C.T. CHAMBER MOVING PORTION
ELECTRO-HYDRAULICALLY OPERATED.

CONDENSER TYPE BUSBARS WITH
TEE-OFF JUNCTION BOXES.

A COMPACT SELF CONTAINED WEATHERPROOF
UNIT ON 5' 9" CENTRES.

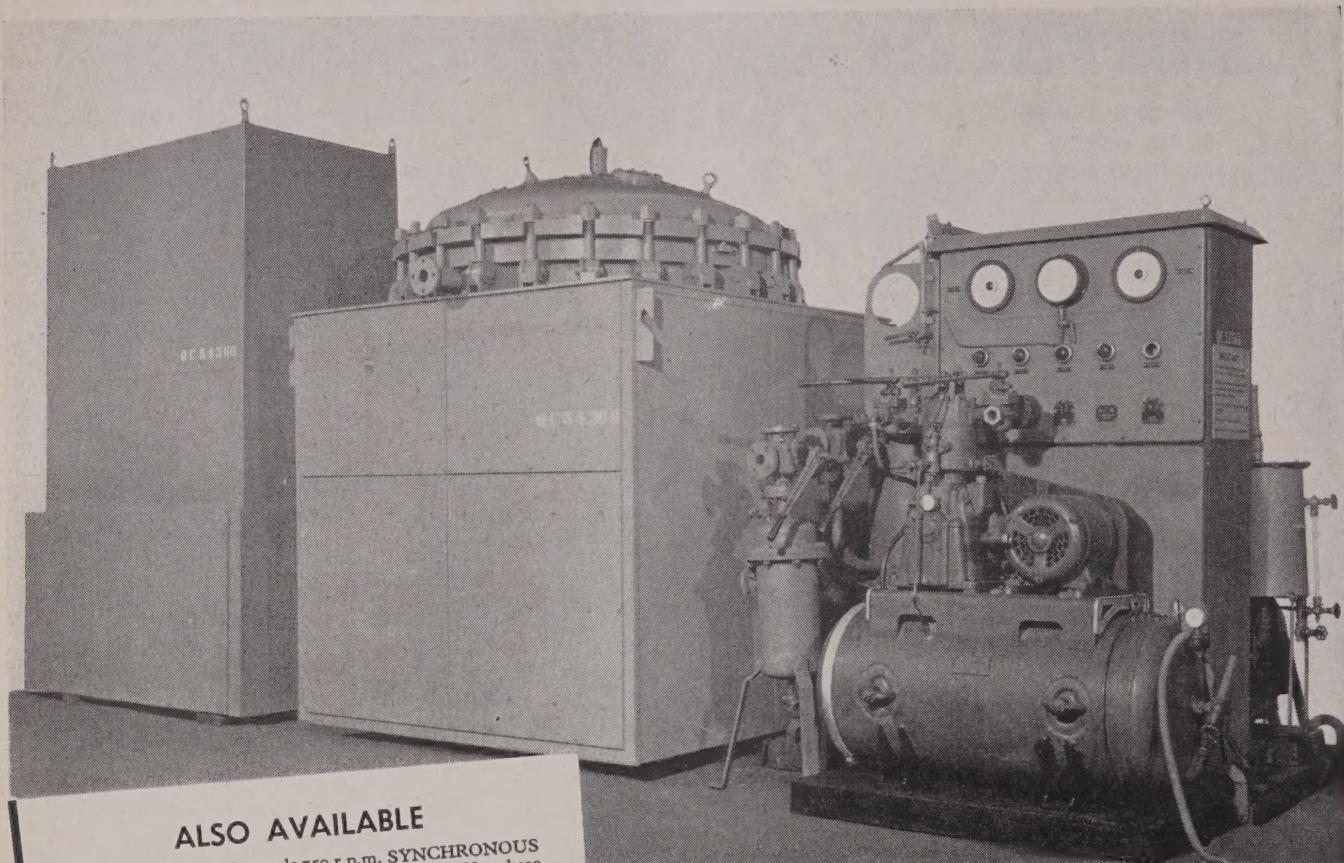


YORKSHIRE SWITCHGEAR & ENGINEERING CO. LTD.

MEANWOOD, LEEDS 6, ENGLAND

TEL. 57121/5

AVAILABLE FROM STOCK



ALSO AVAILABLE

TWO 7,950 h.p. salient pole 750 r.p.m. SYNCHRONOUS MOTORS by *English Electric Co.*, wound for 11 kV 3 phase 50 cycles supply, open frame with two pedestal bearings and direct coupled exciter.

FOUR 1,834 kW 550 volt D.C. GENERATORS by *English Electric Co.*, 750 r.p.m., compound wound with compensating windings, single bearing double shaft arranged for 25 volt excitation, variable voltage.

5,500 kW MOTOR GENERATOR SET by *English Electric Co.*, speed 750 r.p.m., comprising three 1,834 kW 550 volt D.C. generators coupled in tandem and driven from 7,950 h.p. synchronous motor, wound for 11 kV 3 phase 50 cycles supply All on common cast iron baseplate.

QUANTITY of 30 kW 225 volt D.C. GENERATORS by *Mawdsley*, Admiralty type, compound wound, 1,100 r.p.m. cowl protected enclosure, continuously rated.

750 h.p. ROLLING MILL MOTOR by *Brown Boveri*, wound for 2.2 kV 3 phase 50 cycles supply, speed 146 r.p.m., 0.75 power factor, continuously rated, suitable for reversing on load if required. Mounted on baseplate with two pedestal ring oil lubricated bearings.

FOUR 400 h.p. ROLLING MILL MOTORS by *English Electric Co.*, wound for 400 volts 3 phase 50 cycles supply, speed 738 r.p.m., coupled to gearbox giving final 30 r.p.m. With barring motor, control gear, oil pumps, oil cooler.

562.5 kVA 6.6 kV 3 phase 50 cycles 4-wire DIESEL ENGINE DRIVEN ALTERNATOR SET, incorporating 660 h.p. vertical 6-cylinder 4-stroke cycle engine by *Mirrlees Bickerton & Day*, HFB.6. Direct coupled at 375 r.p.m. to alternator by *British Thomson Houston*, with exciter and switchgear.

485 kVA 400 volts 3 phase 50 cycles 4-wire DIESEL ENGINE DRIVEN ALTERNATOR SET, incorporating 540 h.p. vertical 6-cylinder 4-stroke cycle engine by *Ruston & Hornsby*, type VEBX.6. Direct coupled at 500 r.p.m. to alternator by *Brush Electrical*, revolving field, with exciter and switchgear.

COMPLETE MODERN VACUUM IMPREGNATING PLANT by *Barlow Whitney*, comprising vertical mild steel AUTOCLAVE, 5 ft. i.d. x 4 ft. 8 in. deep on straight with dished bottom and fluted domed cover secured by swing bolts; sight and light glasses. Internal working pressure 60 p.s.i. Box framework containing electric heating, mild steel storage and preheating vessel, switchgear control cabinet, thermometers, pressure/vacuum gauges, indicator lamps, Kinney high vacuum pump, solvent condenser, catchpot and piping, Broom & Wade compressor/low vacuum pump on horizontal receiver. (As illustrated above.)

GEORGE COHEN

SONS AND COMPANY LIMITED

WOOD LANE, LONDON, W.12 STANNINGLEY, NR. LEEDS

Telephone : Shepherds Bush 2070

Telephone : Pudsey 2241

Telegrams : Omniplant, Telex, London

Telegrams : Coborn, Leeds



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... Silver-Ring bulkhead fittings in aluminium alloy with clear opalescent or prismatic glass fronts and wire guards are smoothly designed to functional and aesthetic standards. For 60-100w. lamps. Have you details of our full range of bulkhead and wellglass fittings ?

REVO ELECTRIC

REVO ELECTRIC CO. LTD., TIPTON, STAFFORDSHIRE

A Duport Company famous for cookers, fires, fluorescent and industrial light fittings, power tools, street lighting, switch and fusegear etc.

WHEN SILENCE IS A MUST



The new "SX" contactor is designed for completely silent running. Ideal for floor warming and domestic central heating control.

- ★ Fitted with solid silver contacts for continuous running.
- ★ Die cast aluminium dust proof enclosures.
- ★ Rating: 30 amp double and triple pole. 50 amps single pole. 550 V. A.C. (max) complying with BSS. 775 for non-inductive loads.
- ★ Immediate delivery from stocks held in Newport, and branch offices in London, Manchester, Birmingham, Newton Abbot and Leeds.



INSTALL A
NEW!

**Silent
Running**

CONTACTOR

By



SOMERTON WORKS, NEWPORT, MON.

Please write for further details.

TELEPHONE: Newport 71711. London, Shepherds Bush 3311/2. Newton Abbot 2700/1. Manchester, LONGford 4226/7. Birmingham, PRIlory 3924/4333. Leeds 28762



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*manufacture the largest range of
servo motors in the world*

Please ask for Publication EJ.320

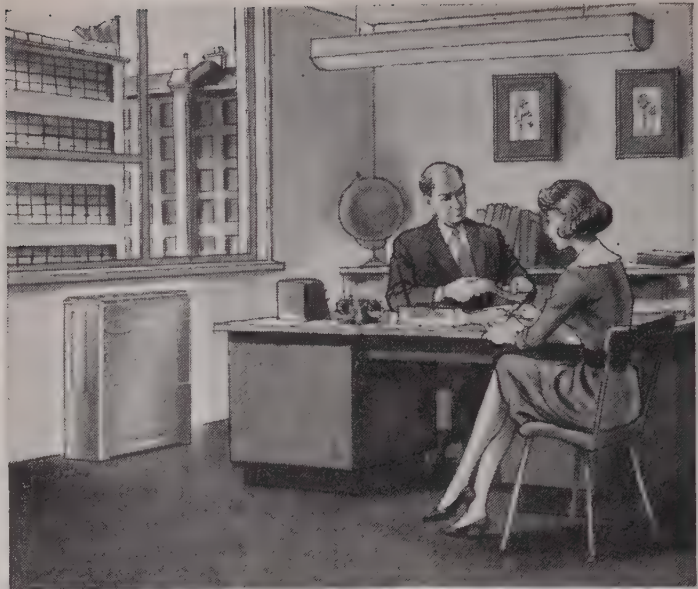
INTERNATIONAL INSTRUMENTS DIVISION

EVERSHED & VIGNOLES LIMITED

ACTON LANE WORKS · CHISWICK · LONDON, W.4

Phone: CHiswick 3670 Telegrams & Cables: Megger London Telex 22583

***Use Off-Peak
Tariffs and
cut the cost of
Heating with***



Nightstor Heaters



CUT FUEL COSTS. Nightstor Heaters store heat by night—taking advantage of the cheaper off-peak tariffs available from all Electricity Boards—and dissipate heat by day. Separate thermostatic control ensures that the heaters use only the minimum current necessary to provide a comfortable temperature throughout the following day from first thing in the morning. Thus Nightstor Heaters are not only efficient and clean, but also represent maximum economy.

CUT CAPITAL COSTS. Simple and inexpensive to install, without alteration to structures or fittings. Nightstor Heaters are compact units which can be safely placed right up against the wall, using the minimum of floor space.

CUT MAINTENANCE COSTS. Controlled automatically, Nightstor Heaters once installed need no maintenance or attention.

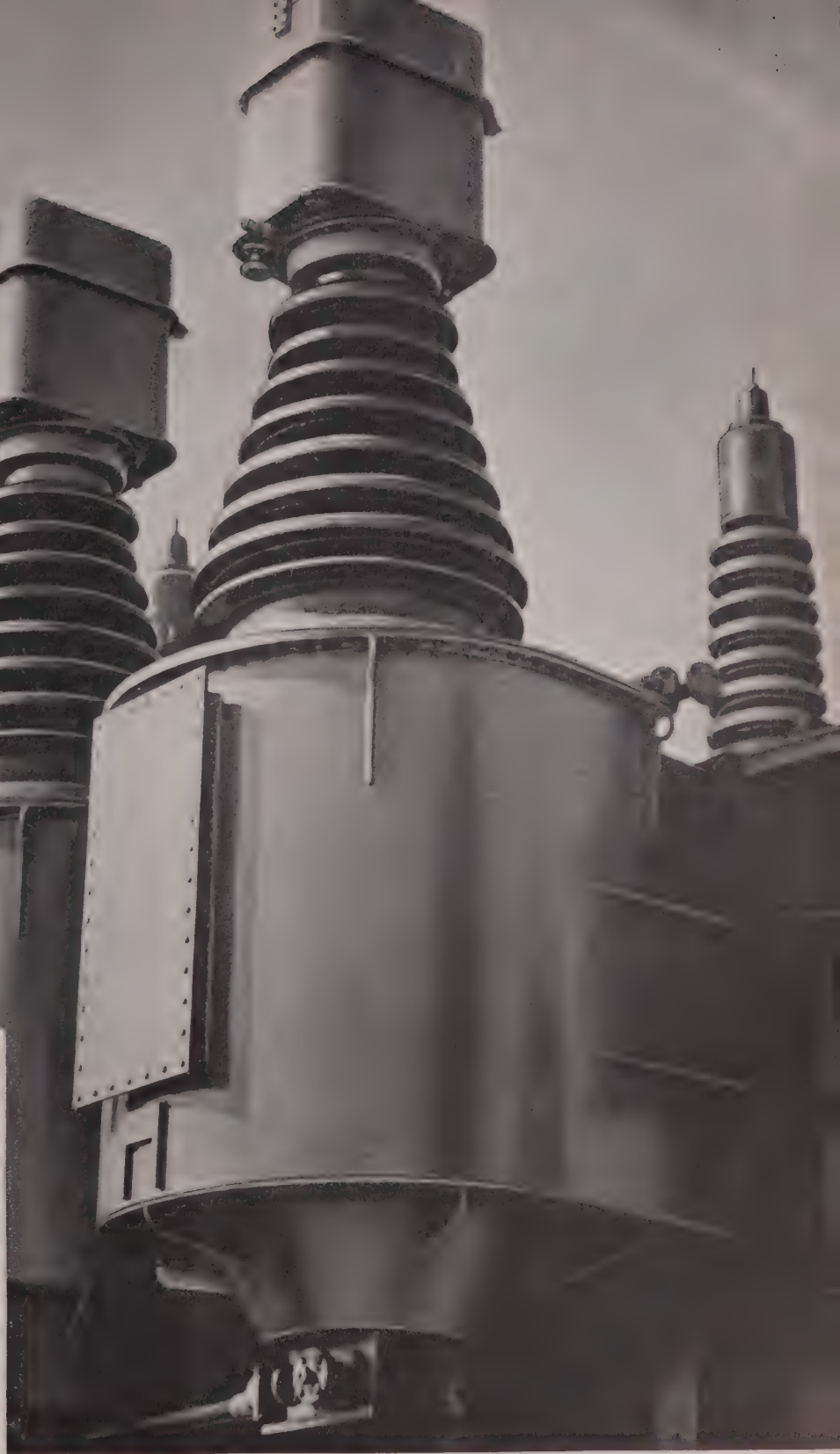
 **Nightstor is a**  **product**
(Not available for domestic use)

A NEW PLAN FOR YOUR CUSTOMERS
Send for details of the new G.E.C. Extended
Credit Plan which earns profits while you pay.

*The G.E.C. specialises in industrial heating and
manufactures every type of appliance.*

Make use of our free advisory service without obligation.

THE GENERAL ELECTRIC COMPANY LIMITED, MAGNET HOUSE, KINGSWAY, LONDON WC2



132 kV fully insulated high speed resistor
on-load tap changers installed on our 120
MVA 275 132 kV Auto-transformer at C.E.G.B.
Northfleet Super-grid Sub-station.

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FULBOURNE ROAD LONDON E17
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ON-LOAD TAP CHANGERS

For every application

We have designed and constructed On-load tap changing equipment for the widest range of applications. We have supplied equipments on our own transformers and to other transformer manufacturers for over thirty years. Our confidence in our tap changers is such that we guarantee a contact life of at least two hundred thousand operations - approximately twenty years' service.



RISING MAIN BUSBAR SYSTEMS

This impressive example of an Ottermill Rising Main Busbar System is incorporated in Caltex House which was erected by Sir Robert McAlpine and Sons, Ltd., on the famous Tattersalls site in Knightsbridge. On each floor, accommodating tenants' switchgear and supplying authorities' fuses and metering, are Ottermill Cubicle Switchboards.

Our engineers would be pleased to give technical advice and assist in preparation of layouts.

Write for Leaflet R.M. 701/57

ARCHITECTS

Stone, Toms and Partners,
28 South Audley St, W.1.

BUILDERS

Sir Robert McAlpine & Sons Ltd,
80 Park Lane, W.1.

ELECTRICAL CONTRACTOR

Edmundsons, Construction Co. Ltd.,
30 Gillingham Street, W.1.



OTTERMILL SWITCHGEAR LTD

SALES OFFICE: 82 VICTORIA STREET, LONDON, S.W.1

Telephone: ABBey 5095/6



Few Londoners who see heavy cables being laid these days—perhaps in their own street—realize that they usually have aluminium conductors.

Last year this cable saved London £100,000. How?

OUR PICTURE shows an ordinary 4 core .3 sq. in. low-voltage distributor cable with aluminium conductors. Aluminium is also being used in 3 core high-voltage feeders at 6.6 kV and 11 kV.

By using cables with aluminium conductors, London saved more than £100,000 last year. How?

The price of copper varies considerably. Recently it has fluctuated between £240 and £270 a ton; at times it has been much higher. Aluminium costs £186 a ton and its price is steady. More important, a ton of aluminium provides twice as much conductor material as a ton of copper. Consequently, aluminium is now the cheapest conductor material and, in nine cases out of ten, the most economical for the job. And because it is much lighter, aluminium cable is also easier to transport and lay. Jointing is easy and dependable.

Aluminium and power Progressive power authorities are turn-

ing to aluminium cables to help them offset rising costs. So is industry at large, for whether insulated with paper, rubber or plastic, aluminium conductors provide a much cheaper way of handling heavy currents—in factories, office buildings, mines and ships.

Alcan's part Through research, we are working to make sure that aluminium holds its lead as the cheapest conductor metal and that its many inherent technical advantages are fully exploited. With 4,650,000 h.p. of hydro-electric power at our elbow, we are smelting aluminium in tremendous volume, and as demand increases we can readily step up our capacity. This volume production helps to keep the price stable.

Any leading cable manufacturer will be glad to supply you with aluminium cables or give you further information about their use in industry. Or write to: **Alcan (U.K.) Limited**, Aluminium Canada House, 30 Berkeley Square, London, W.1. Telephone: MAYfair 9721.

Britain's most widely used aluminium

ALCAN  **ALUMINIUM**

ALCAN
ALUMINIUM LIMITED OF CANADA

STERLING INSULATING VARNISHES

Sterling varnishes, used in every phase of the electrical industry, are individually blended by our chemists for efficient service under all climatic conditions. With a proud record of over 60 years service, our experience is at your disposal and our advice incurs no obligation.

MADE BY CHEMISTS

Sterling
INSULATING VARNISHES

SERVICED BY ENGINEERS

THE STERLING VARNISH CO. LTD., FRASER ROAD, TRAFFORD PARK, MANCHESTER 17 Tel: Trafford Park 0282 (4 lines) Grams: 'DIELECTRIC', MANCHESTER

London Office & Warehouse:—6 London Road, Brentford, Middlesex

Telephone: Isleworth 8133/4

dm ST 22

Specialists in insulating **FORMERS, BOBBINS,** and wire wound **RESISTORS**

25 Years experience of manufacturing Bobbins and Formers enables us to satisfy the most exacting requirements of the Electrical and Electronic Industries. We fabricate 3 million Bobbins each year and manufacture in any insulating materials including Bakelite and Presspahn.



ARMAND TAYLOR & CO. LTD.

TUSKITE WORKS, MARSH ROAD, PITSEA, ESSEX.

Phone VANGE 2167/8

Tear out this List - and keep for easy reference!

FERRANTI

SILICON SEMICONDUCTOR DEVICES

SIGNAL DIODES

DIMENSIONAL DIAGRAM B

ZS30A — ZS34B DIFFUSED JUNCTION

Type	Max. P.I.V. Volts	Max. Mean Dissipation at 25°C Amb. mW	Max. Mean Dissipation at 100°C Amb. mW	Max. Reverse Current in μ A at P.I.V.		Max. Mean Rectified Current at 25°C Amb. mA	Max. Forward Voltage at Max. Current Volts	Ambient Temp. Operating Range °C
				at 25°C	at 100°C			
ZS30A	50	650	300	0.2	15	500	1.1	-70 to +160
ZS30B	50	650	300	5.0	50	500	1.1	-70 to +160
ZS31A	100	650	300	0.2	15	500	1.1	-70 to +160
ZS31B	100	650	300	5.0	50	500	1.1	-70 to +160
ZS32A	200	650	300	0.2	15	500	1.1	-70 to +160
ZS32B	200	650	300	5.0	50	500	1.1	-70 to +160
ZS33A	300	650	300	0.2	15	500	1.1	-70 to +160
ZS33B	300	650	300	5.0	50	500	1.1	-70 to +160
ZS34A	400	650	300	0.2	20	500	1.1	-70 to +160
ZS34B	400	650	300	5.0	50	500	1.1	-70 to +160

SIGNAL DIODES

DIMENSIONAL DIAGRAM A

ALLOY JUNCTION

ZS10 to ZS25

P.I.V. 60 to 500 volts

Mean Rectified Current at 75°C Amb. Temp. = 100mA

Max. Reverse Current at 100°C = 5 μ A

Max. Operating Temp. = 150°C

PNPN SWITCHING DIODES

DIMENSIONAL DIAGRAM G

Type	Trigger Voltage Volts	Sustaining Current mA	Max. Mean Dissipation at 25°C Amb. mW	Typical Switching Times
DS1E	100 \pm 10%	> 200 μ A < 2mA	100	From high to low impedance < 100 m μ sec.
DS1F	100 \pm 10%	> 2 mA < 10mA	100	From low to high impedance approx. 1 μ sec.
DS1G	100 \pm 10%	> 10mA < 25mA	100	

PHOTOCELLS

Type	Shape	Dimensions of Unmounted Units		Typical Characteristics at 25°C ambient temp.			
		mm	Active Area (Nominal) mm	100 ft Candles		5000 ft Candles	
				V _{oc} mV	I _{sc} mA	V _{oc} mV	I _{sc} mA
MS1*	Rect.	4.8 x 2.3 x 0.8	4.1 x 2.3	400	0.25	530	1.3
MS2	Rect.	19.0 x 12.7 x 0.8	19.0 x 12.0	350	0.65	530	33.0
MS4	Rect.	6.3 x 6.3 x 0.8	6.3 x 5.5	400	0.10	530	5.0
MS5	Rect.	6.3 x 12.7 x 0.8	5.5 x 12.7	390	0.20	530	9.9
MS6	Rect.	6.3 x 19.0 x 0.8	5.5 x 19.0	380	0.30	530	14.8
MS7	Rect.	6.3 x 25.4 x 0.8	5.5 x 25.4	370	0.40	530	19.8
MS9*	Rect.	3.4 x 1.3 x 0.8	2.5 x 1.25	400	0.02	530	0.70
MS11	Circ.	25.4 Dia. x 0.8	12.0 (Rad.)	330	1.33	520	66.5

* The MS1 and MS9 photocells are available for both low and high light level applications, they may also be supplied in matched sets. For further information see manufacturers full data. Details of mounted sizes available supplied on request.

HIGH SPEED DIODES

DIMENSIONAL DIAGRAM A

ALLOY JUNCTION

ZS40, ZS41, ZS42

P.I.V. 25, 50, 100 volts

Max. Mean Rectified Current = 25mA

Max. HOLE STORAGE for 10mA Forward Current = 2.5×10^{-10} Coulombs

HIGH VOLTAGE RECTIFIER UNITS

DIMENSIONAL DIAGRAM C

Type	Max. P.I.V. Volts	Max. Mean Rect. Current at 25°C Amb. mA	Max. Reverse Current at 25°C μ A	Max. Forward Voltage at 100 mA Volts
HS30	5,000	350	0.5	20
HS31	7,500	350	0.5	25
HS32	10,000	350	0.5	30

POWER RECTIFIERS

DIFFUSED JUNCTION

1.5 AMP TYPES

DIMENSIONAL DIAGRAM D

ZR10 to ZR14

P.I.V. 50 to 400 volts.

Mean Rectified Current at 100°C Amb. = 0.6 AMPS

8 AMP TYPES

DIMENSIONAL DIAGRAM E

Type	Max. P.I.V. Volts	Max. Mean Rectified Current		Max. Reverse Current at P.I.V. 25°C mA
		at 25°C Amb. Amps	at 100°C Amps	
ZR20	50	8*	4*	0.05
ZR21	100	8*	4*	0.05
ZR22	200	8*	4*	0.05
ZR23	300	8*	4*	0.05
ZR24	400	8*	4*	0.05

30 AMP TYPES

DIMENSIONAL DIAGRAM F

Type	Max. P.I.V. Volts	Max. Mean Rectified Current		Max. Reverse Current at P.I.V. 25°C mA
		at 25°C Amb. Amps	Forced Air Cooled Amps	
ZR30C	50	30*	40†*	0.5
ZR31C	100	30*	40†*	0.5
ZR32C	200	30*	40†*	0.5
ZR33C	300	30*	40†*	0.5
ZR34C	400	30*	40†*	0.5
ZR35C	500	30*	40†*	0.5

* Mounted on Standard Ferranti Cooling fin. † Air flow: 600 linear ft per min. at 25°C Ambient. In the above devices the flying lead corresponds to the cathode of a thermionic rectifier. Reverse polarity types are available and should be specified by a suffix R after the type number, e.g. ZR34CR.

ZENER REFERENCE DIODES

DIMENSIONAL DIAGRAM A

ALLOY JUNCTION

Type	Nominal Reference Voltage at 5mA	Tolerance %	Typical Slope Resistance Ohms 5mA	Temp. Coeff. at 5mA % per °C	
	5mA		5mA	Upper Limit	Lower Limit
KS30A	3.3	Suffix 'A' indicates 5%. Suffix 'B' indicates 10%.	110	-0.03	-0.08
KS30B	3.3		110	-0.02	-0.08
KS31A	3.6		85	-0.02	-0.06
KS32A	3.9		70	-0.02	-0.06
KS32B	3.9		70	-0.01	-0.06
KS33A	4.3		65	-0.01	-0.05
KS34A	4.7		60	0.00	-0.04
KS34B	4.7		60	+0.01	-0.05
KS35A	5.1		55	+0.02	-0.03
KS36A	5.6		35	+0.03	-0.02
KS36B	5.6		50	+0.04	-0.03
KS37A	6.2		8	+0.05	0.00
KS38A	6.8		8	+0.07	+0.02
KS38B	6.8		8	+0.07	+0.01
KS39A	7.5		6	+0.07	+0.03
KS40A	8.2		6	+0.08	+0.04
KS40B	8.2		6	+0.08	+0.04
KS41A	9.1		8	+0.08	+0.05
KS42A	10.0		15	+0.08	+0.05
KS42B	10.0		15	+0.08	+0.05
KS43A	11.0		20	+0.08	+0.05
KS44A	12.0		25	+0.09	+0.05
KS44B	12.0		25	+0.09	+0.05

VOLTAGE REGULATORS

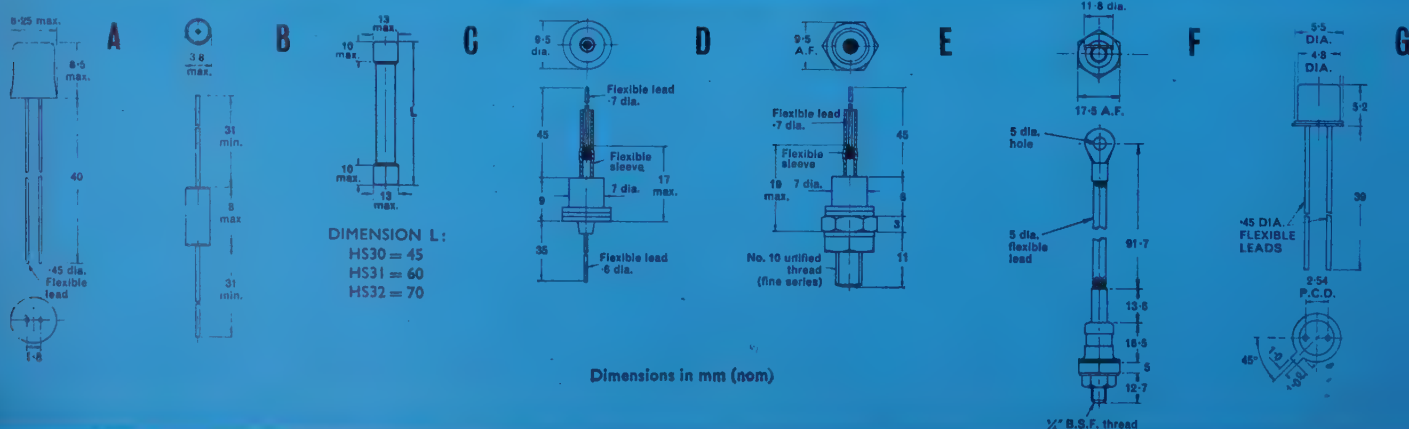
DIMENSIONAL DIAGRAM E

Type	Nominal Reference Voltage at 50mA Ref. Current Volts	Tolerance on Nominal Reference Voltage %	Max. Slope resistance at 50 mA reference Current Ohms	Max. dissipation on 2 1/2" x 2 1/2" x 1/8" Cu. or Al fin. Watts	Max. Temp. Coefficient 20 mA % per °C
KR52	22	10	5	8	0.09
KR53	27	10	5	8	0.09
KR54	33	10	5	8	0.09
KR55	39	10	6	8	0.09
KR56	47	10	8	8	0.09
KR57	56	10	11	8	0.10
KR58	68	10	14	8	0.10
KR59	82	10	20	8	0.11
KR60	100	10	30	8	0.12

In the above devices the flying lead corresponds to the cathode of a thermionic rectifier.

Reverse polarity types are available and should be specified by a suffix 'R' after the type number, e.g. KR54R.

DIMENSIONAL DIAGRAMS



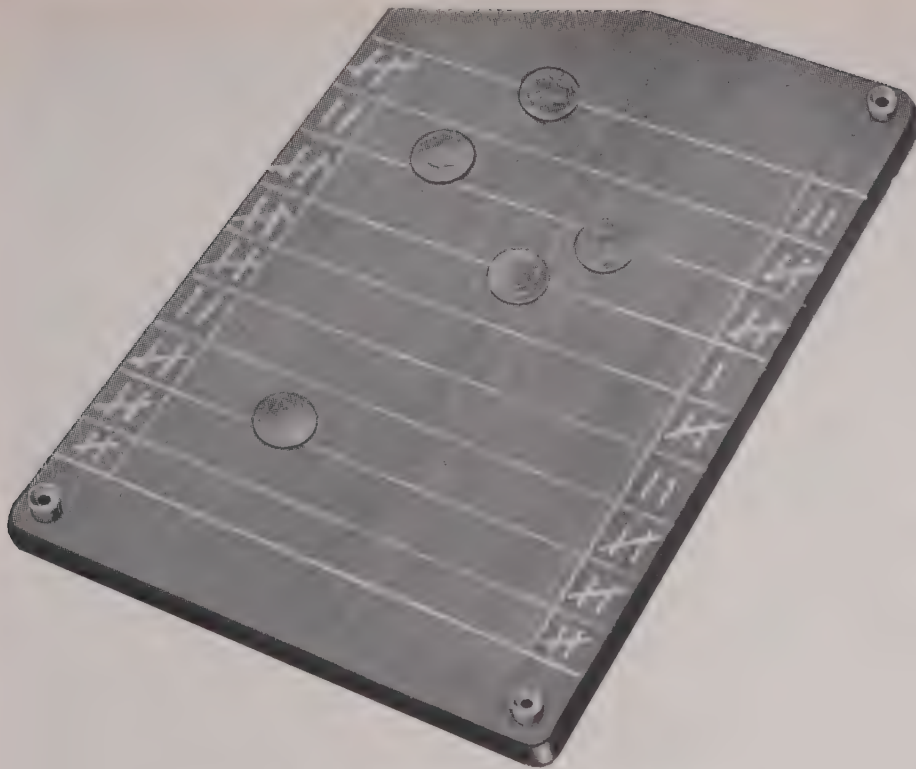
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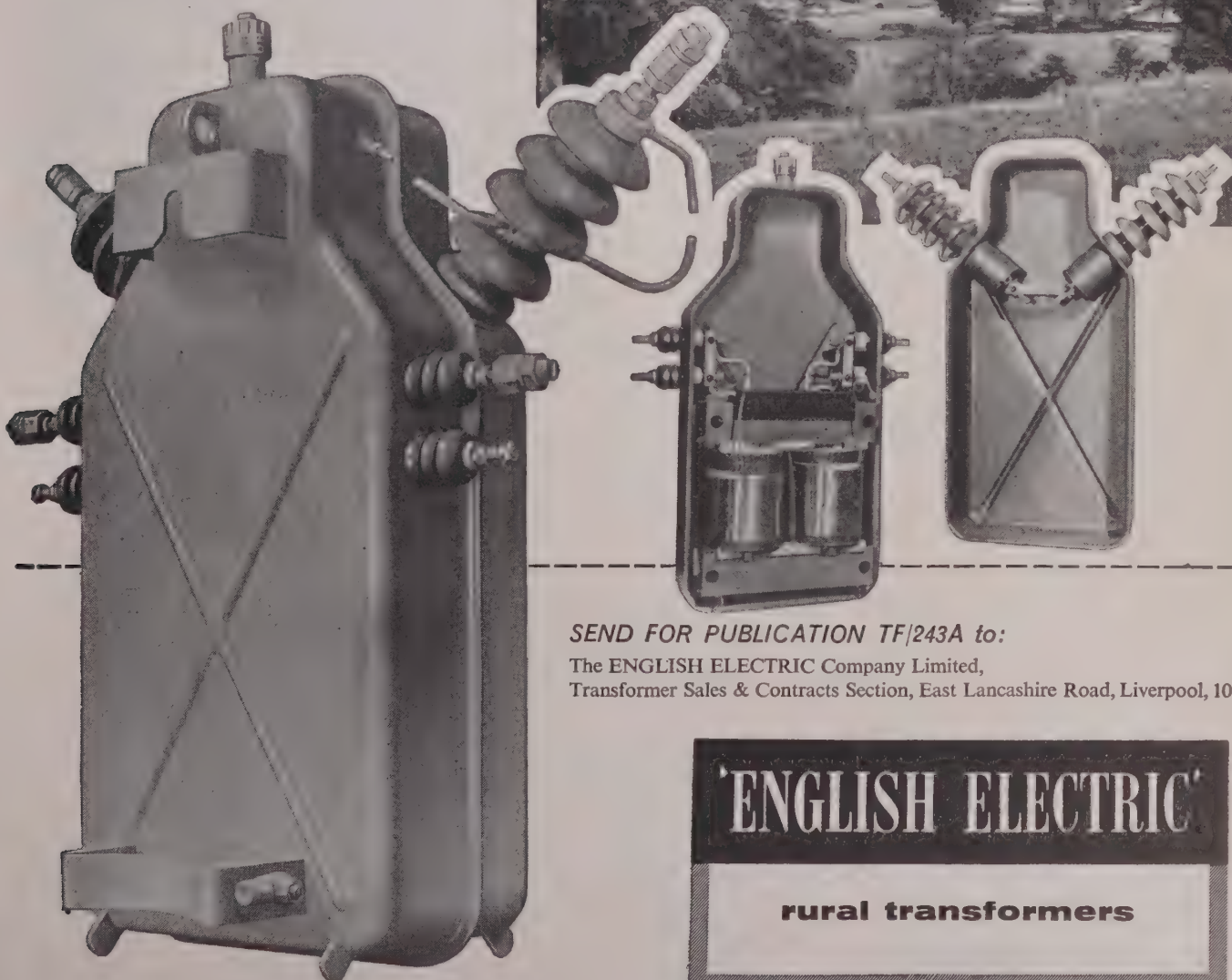
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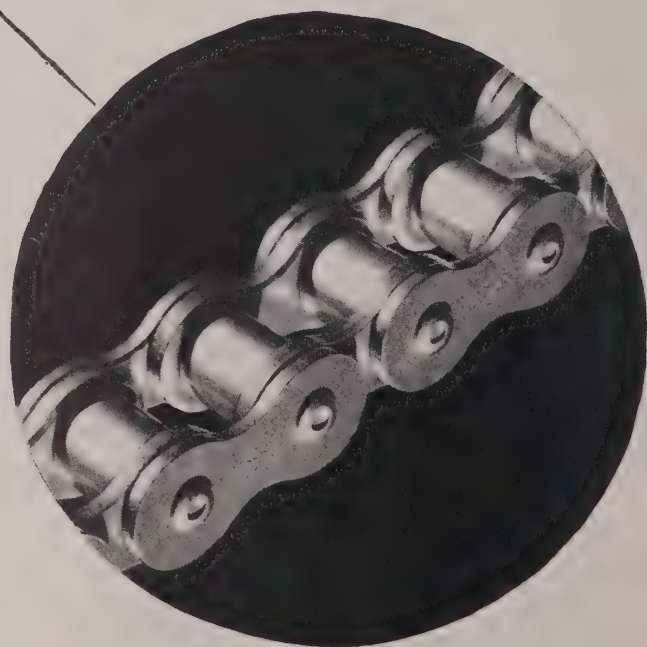
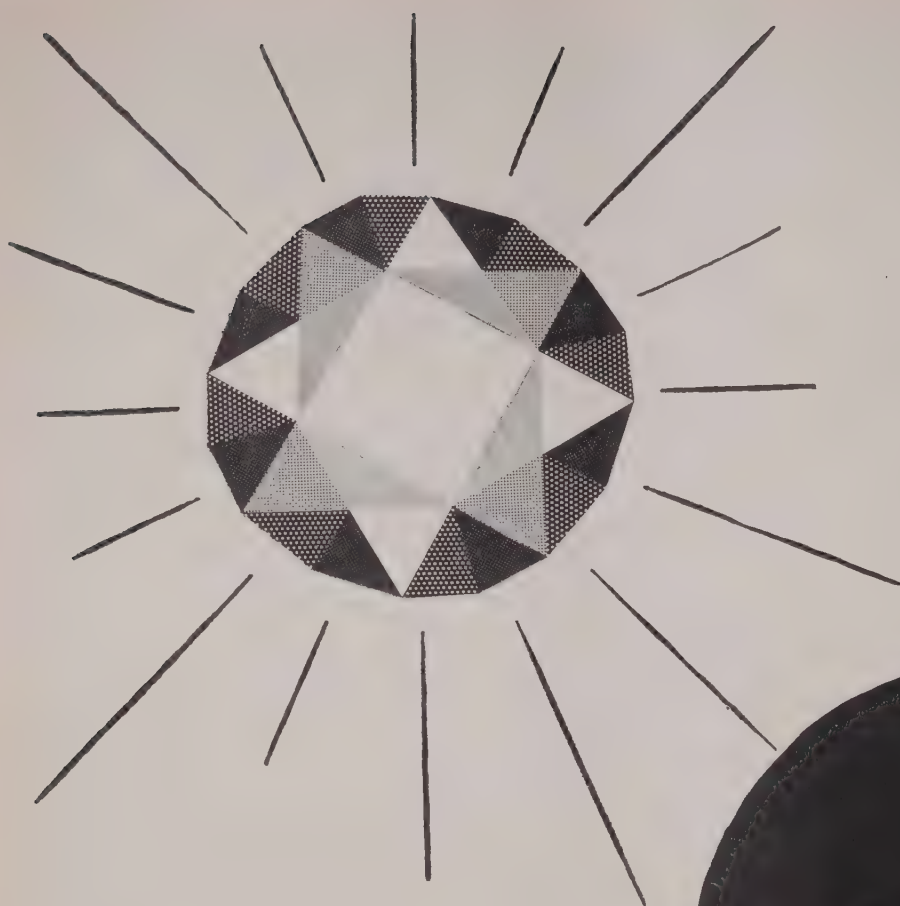
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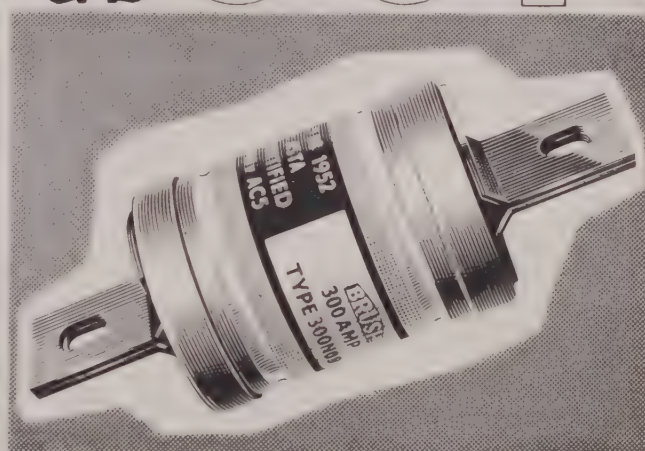
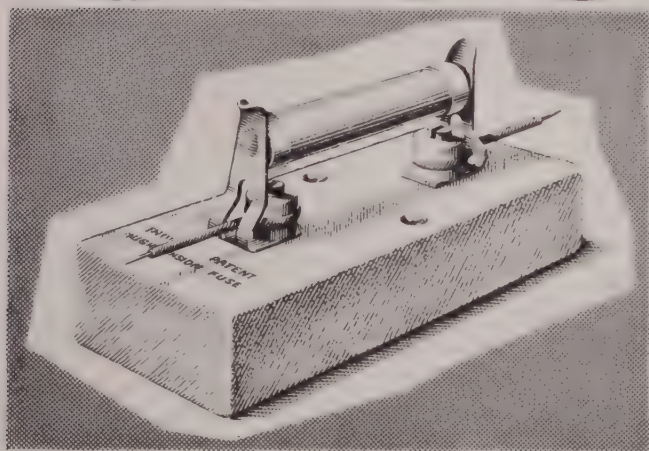
Fuse for thought—



893



961



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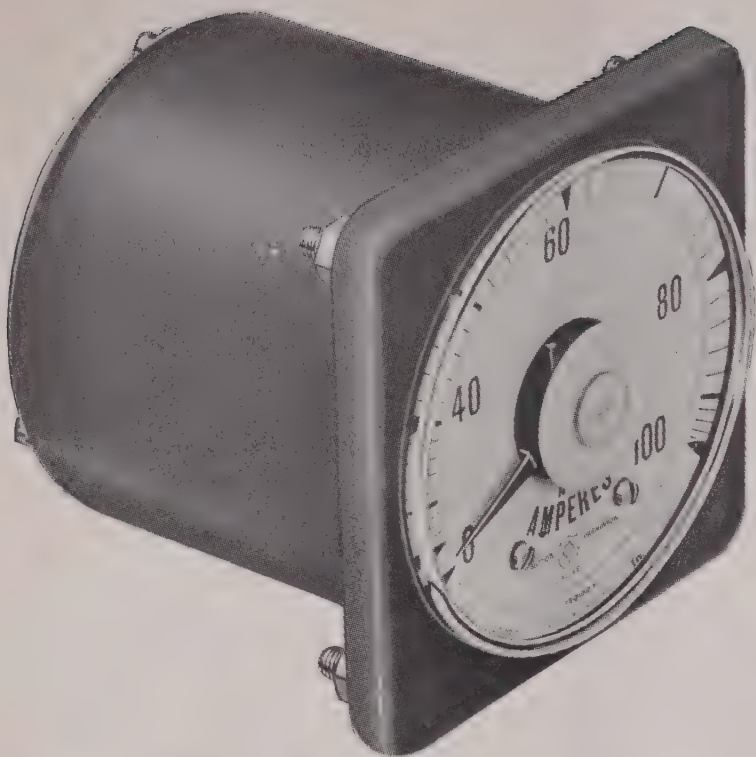
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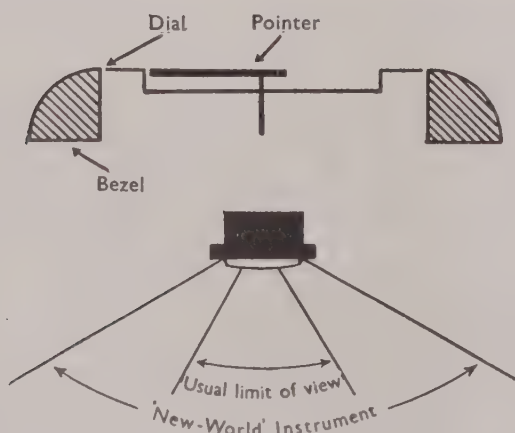


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pleasure, of course . . . it did. It's quite a small machine, considering what it does, and our Print Department consists of one man and one girl. But it's fantastically versatile . . . turns out everything from canteen menus to four-colour Christmas cards. (You come round and I'll get Brace to show you the figures; some quite spectacular savings there. And you can play with the machine, too.) No, but seriously, Ted. I think Gestelith's the answer to your problem.

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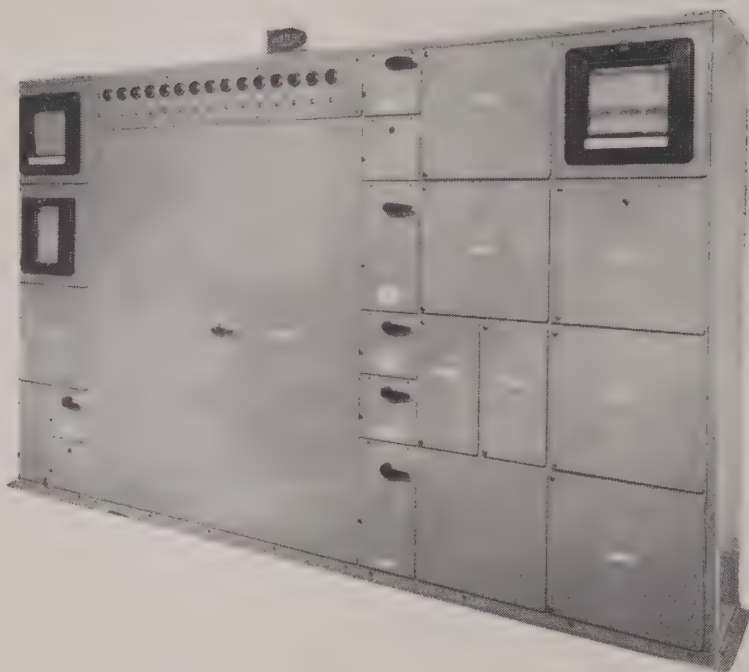
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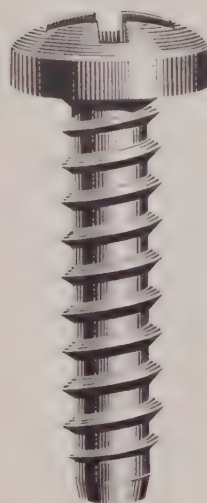
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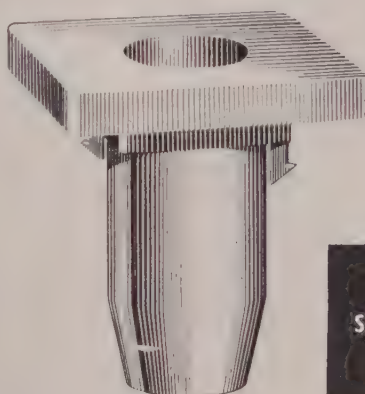
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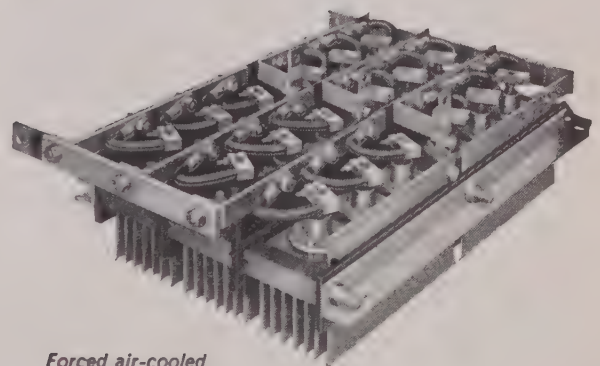
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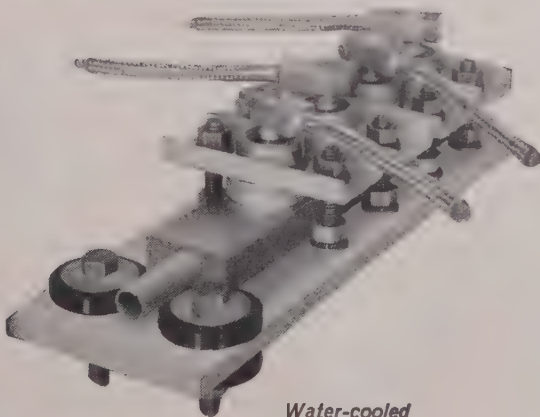
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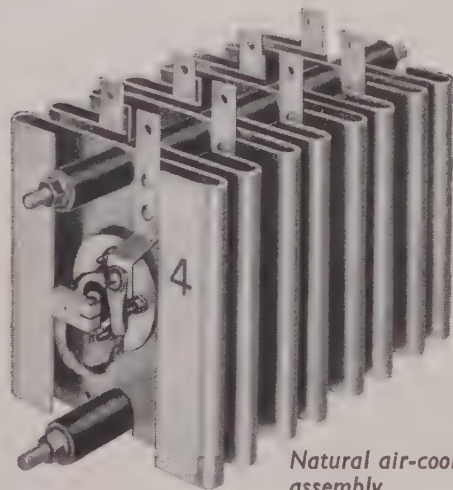
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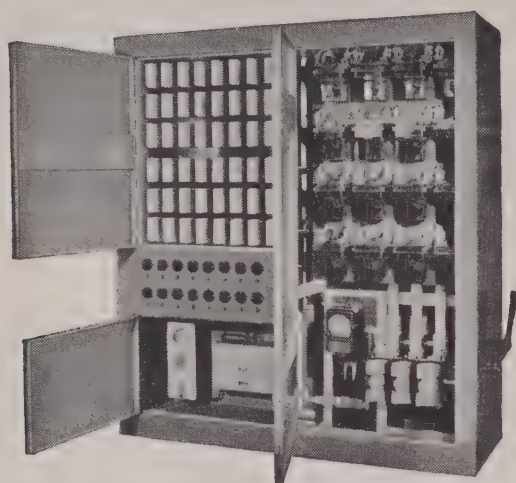
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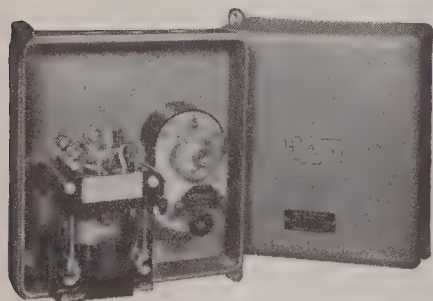
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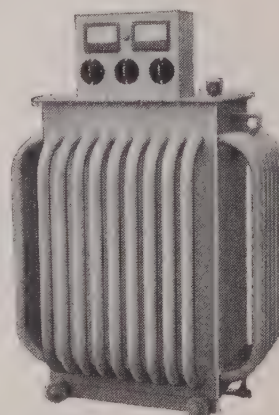
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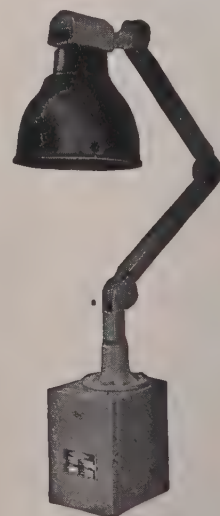
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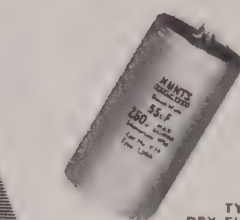
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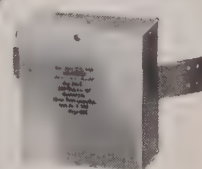
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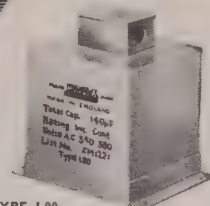
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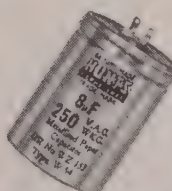
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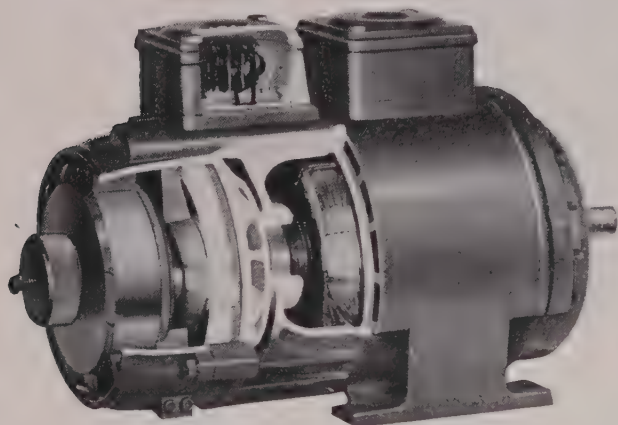
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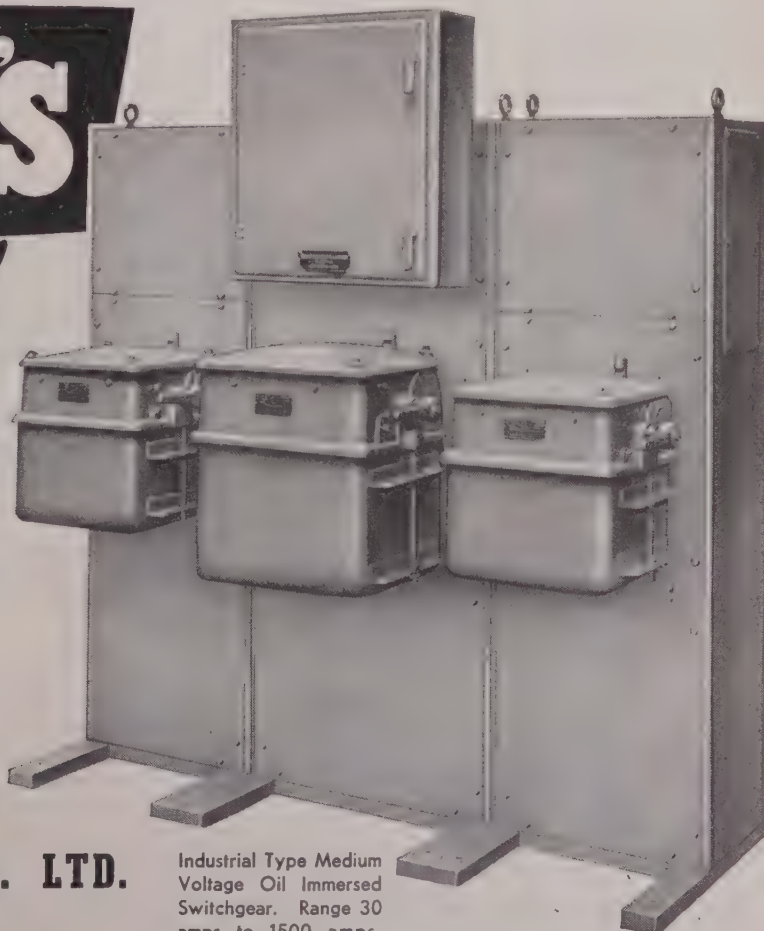
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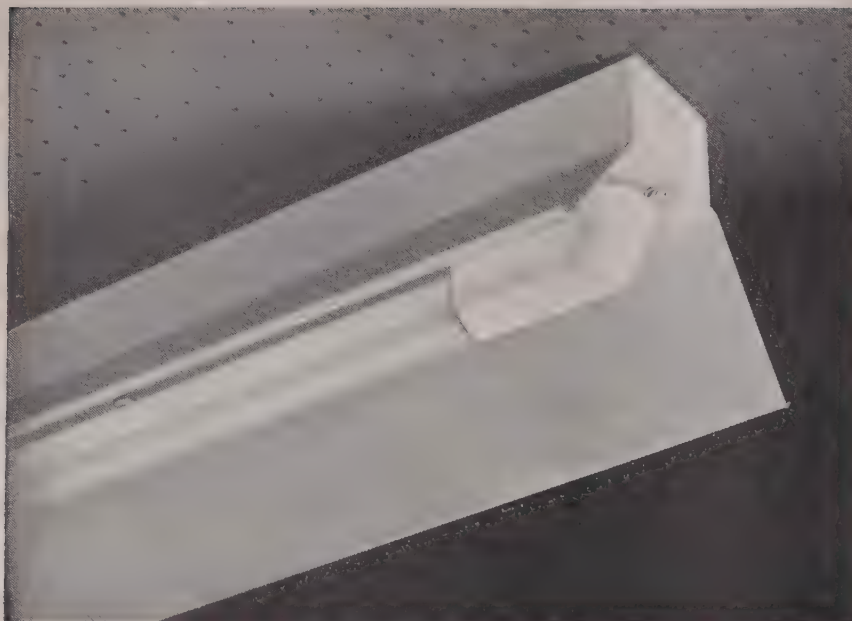
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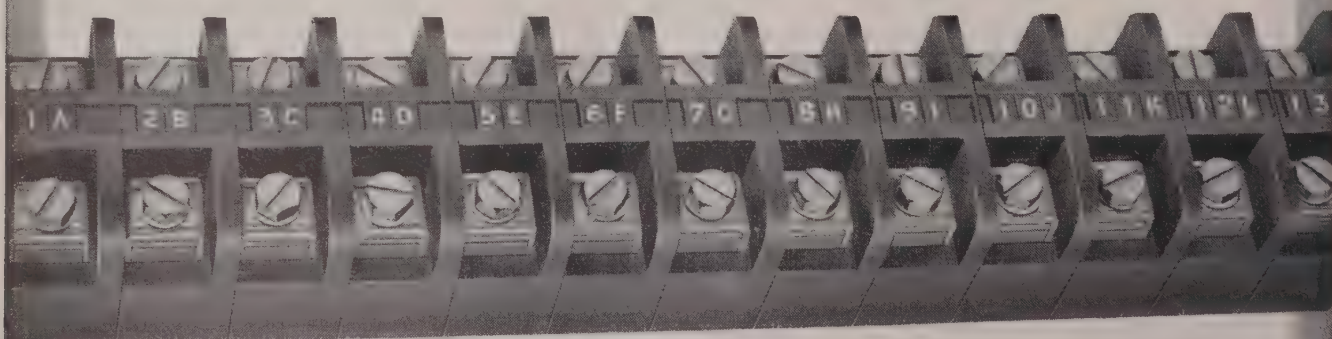
OT501 **£4-7-6** switch start less lamp
fitting brochure sent on request

WADES (HALIFAX) limited

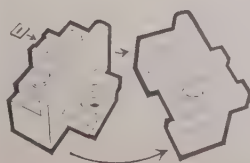
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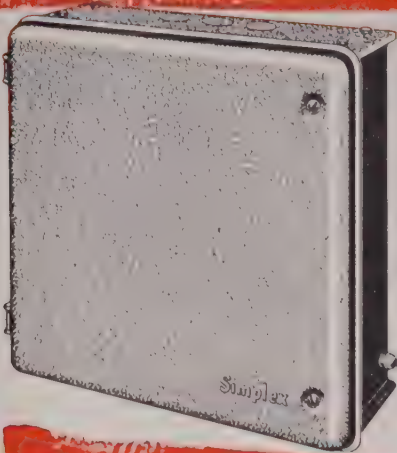
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Simplex Star Switchgear

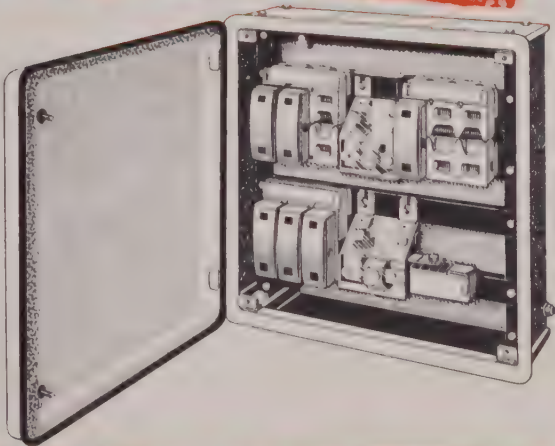
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Simplex Star "dead-front" Distribution Fuseboards are: low in price • easy to wire • completely safe because all live parts are shrouded, even with the fuses removed. There is provision for: circuit identification on the fuse bank and neutral connections • surface or flush mountings, Ratings — 15, 30 or 60 amp, 500 volt A.C. or 250 volt D.C. Star Economy Distribution Fuseboards offer the same advantages as the Star Distribution Boards at the lowest possible price. More details of Simplex Star Distribution Fuseboards available on request.

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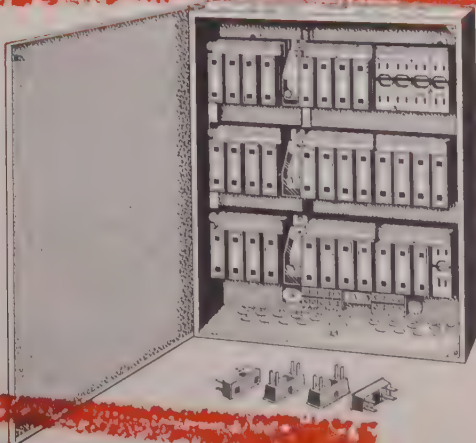
Star Distribution Fuseboard. Neat appearance. Strong All-Steel case.



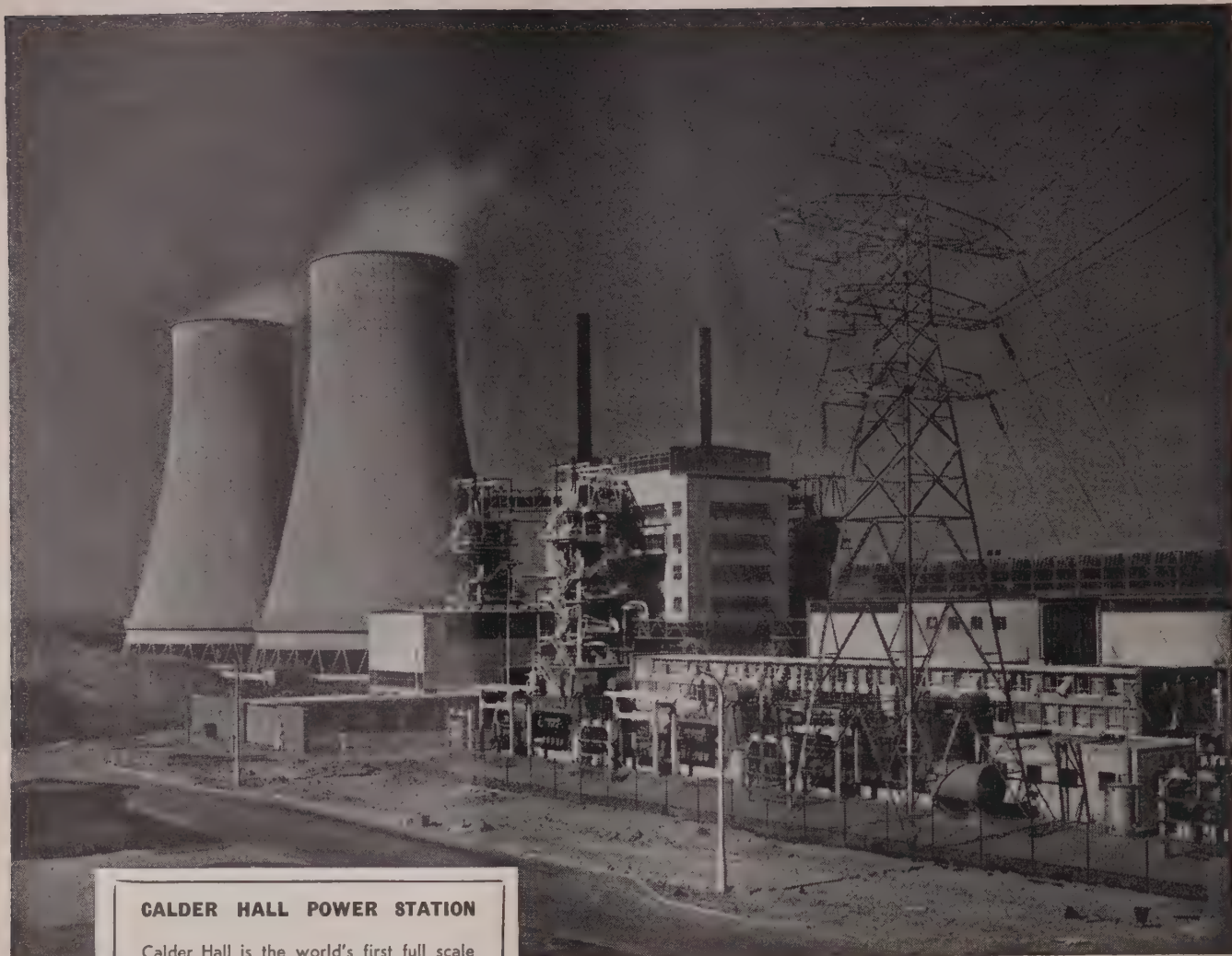
Star Distribution Fuseboard with cover open; some fuses are removed to show dead-front feature.



Star Economy Distribution Fuseboard.



Star Economy Distribution Fuseboard with cover open showing shields, and dead-front feature when fuses are removed.



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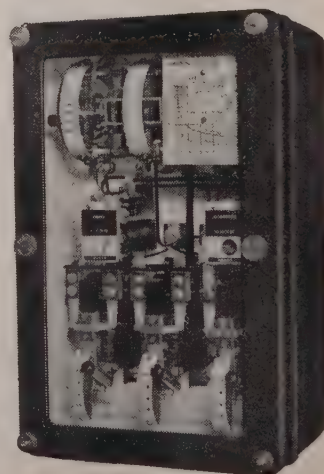
P & B Relays give full protection for motors with any starting periods or currents under extremes of ambient temperature.

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Moving Iron Ammeter

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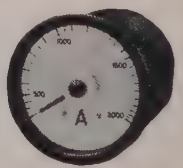
*For literature giving full details, write to:
The ENGLISH ELECTRIC Company Limited,
Instrument Department, Stafford*



Round Projecting



Square Flush



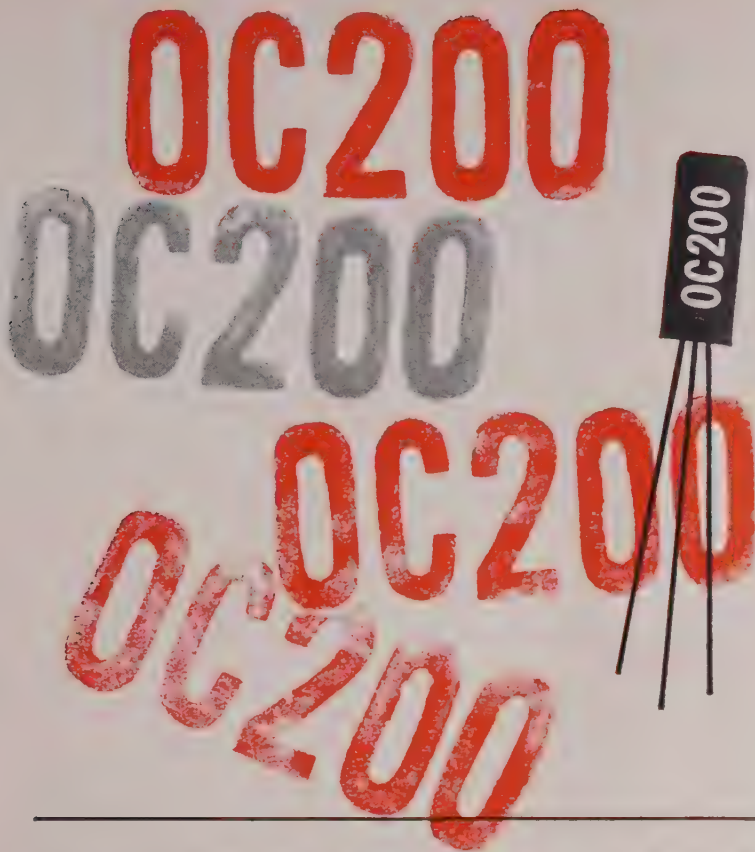
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instruments

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Maximum junction temperature (°C)		+ 150
Abridged data (at Tambient 25°C)		
V _{cb} max.	(V)	- 25
V _{ce} (cut-off) max.	(V)	- 25
V _{ce} (I _c =50mA) max.	(V)	- 20
I _c (pk) max.	(mA)	50
I _c max.	(mA)	50
α' (f=1kc/s) spread		15 to 60
V _{ce} (I _c =7mA, I _b =1mA)	(mV)	- 130
r _{bb} ¹ (V _{ce} = -6V, I _c =1mA)	(Ω)	125

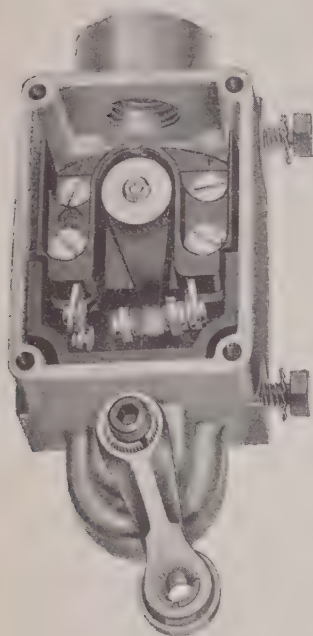
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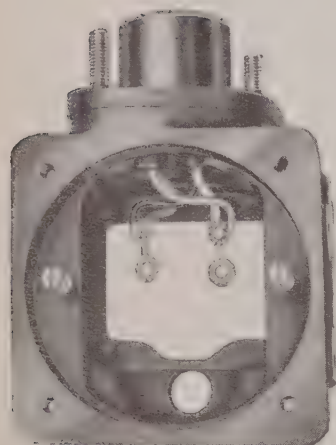




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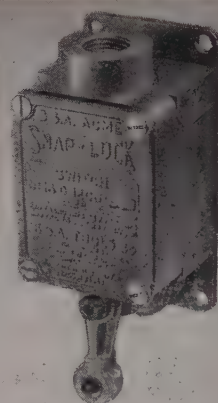
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SNAP-LOCK
ACME**

Catalogue of switches and levers on request

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Oil
and
Dustproof
or
Flameproof
versions**

**Standard
Neutral
position
or
Centre
connection**

MARK II

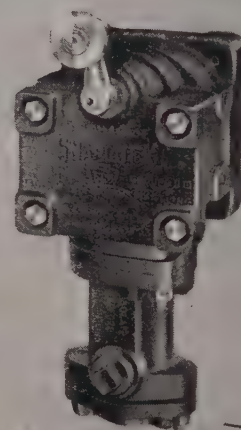


4 3/4"

STANDARD

WATER, OIL & DUSTPROOF

Single pole, double break, double throw, operates with either circuit normally open with other closed, or maintaining in either position, or available with central (neutral) position and/or centre connection. Heavy aluminium die-cast case. Conduit 3/4" B.S., or No. 3 Admiralty Pattern Cable gland entry. Two-screw side mounting or backplate mounting in two styles, or Tandem style (back to back mounting). Operating lever position adjustable in 7.5 deg. increments through 82.5 deg. either way from normal.



10"

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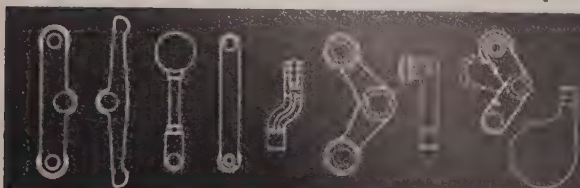
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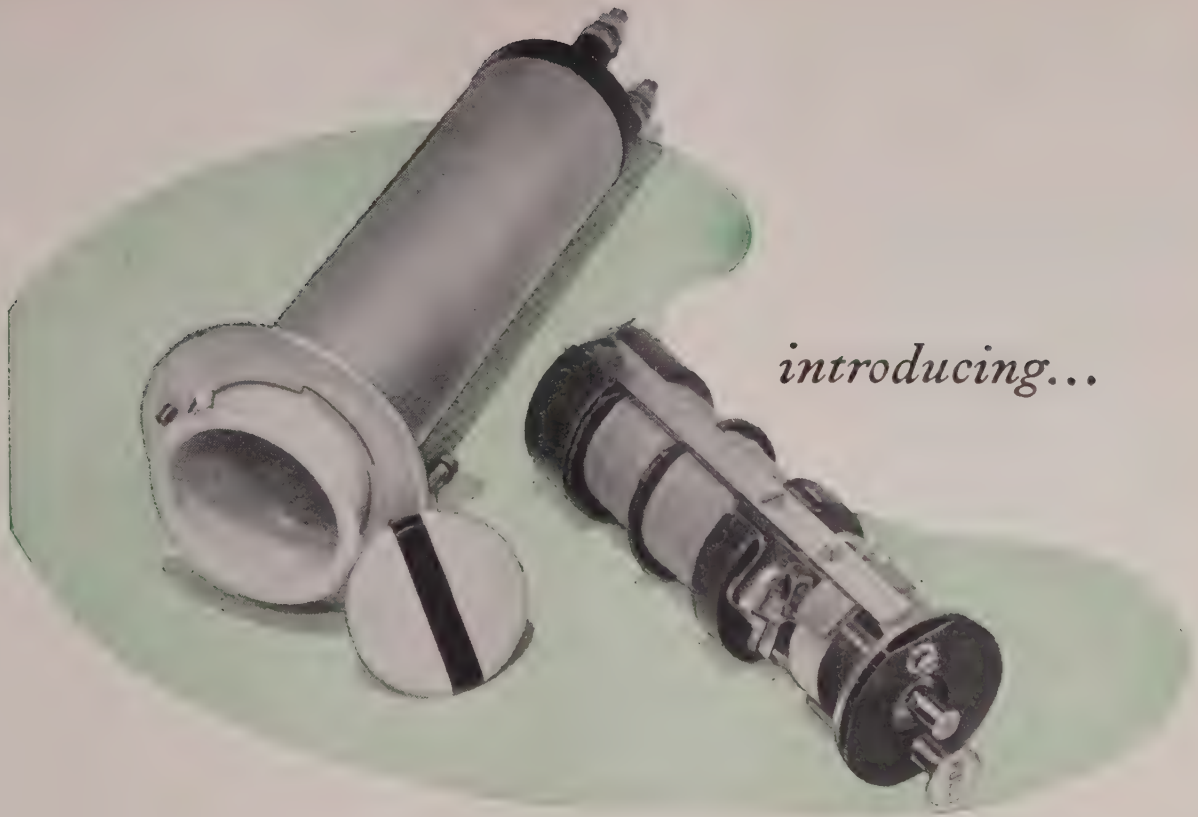
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introducing...

... .. the new type-BA semaphore indicator for the automatic indication of the position of circuit-breakers and isolators.

The operating-coils of these indicators are continuously-rated but built-in contacts break the circuit on completion of movement to prevent unnecessary drain on battery supplies.

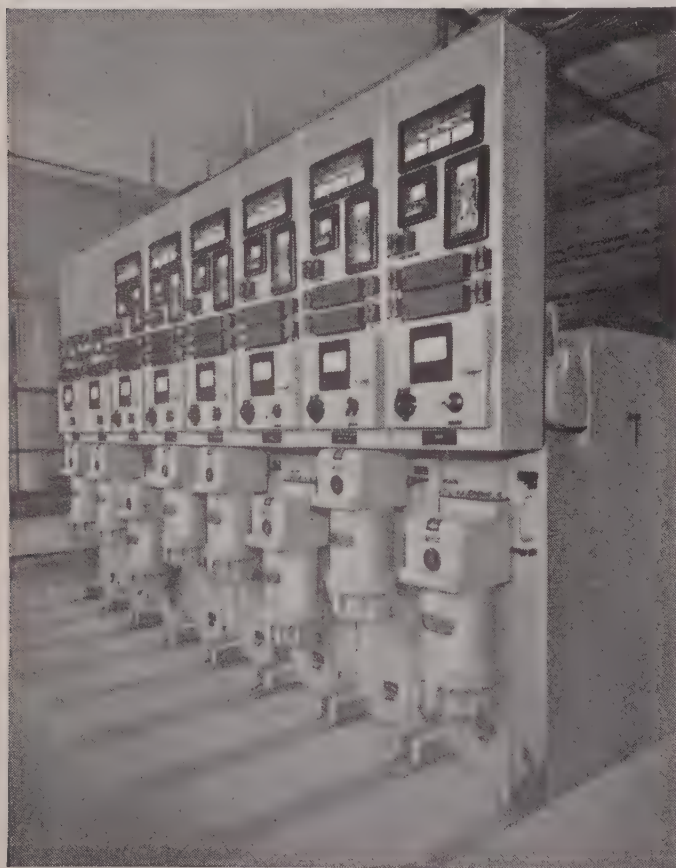
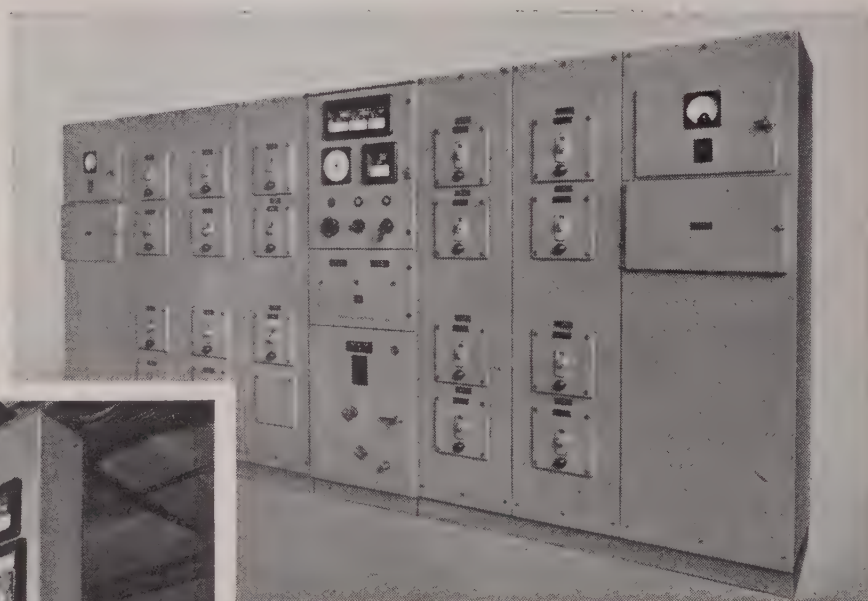
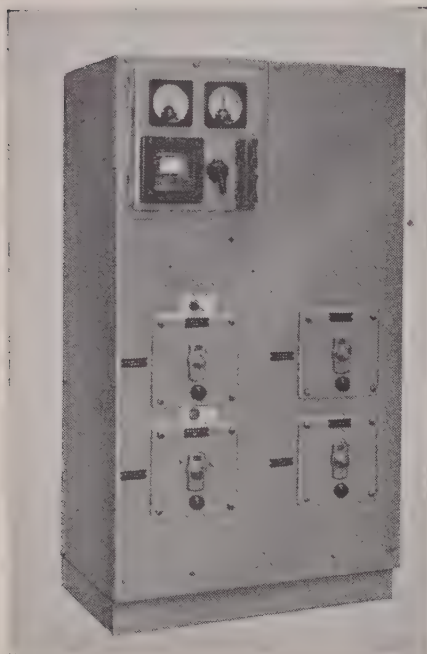
This semaphore indicator plugs in from the front of the panel and is available with discs of either 1½" or 2½" diameter.

Reyrolle

A. REYROLLE & COMPANY LIMITED - HEBBURN - COUNTY DURHAM - ENGLAND

South Wales Switchgear in the picture

at the new B.B.C. T.V. centre



Top Left and Above. 2 fuse-switchboards controlling medium voltage supplies.

Bottom Left. One of the five 11kV 250MVA switchboards.

Switchgear plays a vital role in Television presentation. S.W.S. switchgear ensures the safe and dependable supply of electrical power to this important phase of human activity.

5 Switchboards comprising 30 panels of 11,000 volts 250MVA switch units and 3-panel ring main unit, together with 10 fuse-switchboards comprising 94 circuits, distribute a high voltage and medium voltage supplies at the new T.V. centre of the British Broadcasting Corporation.



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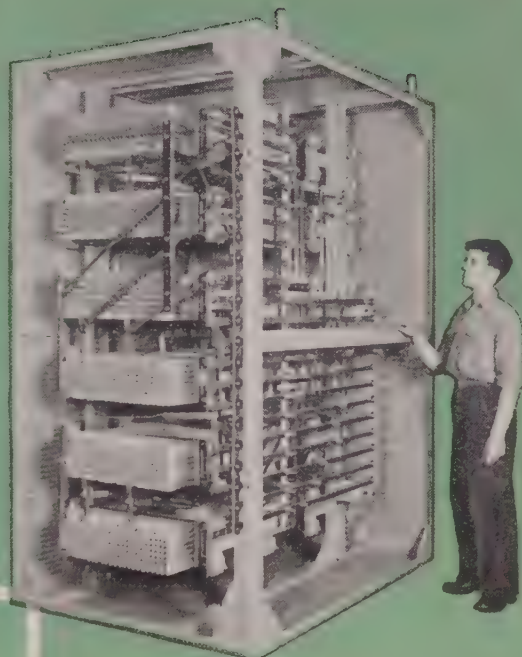
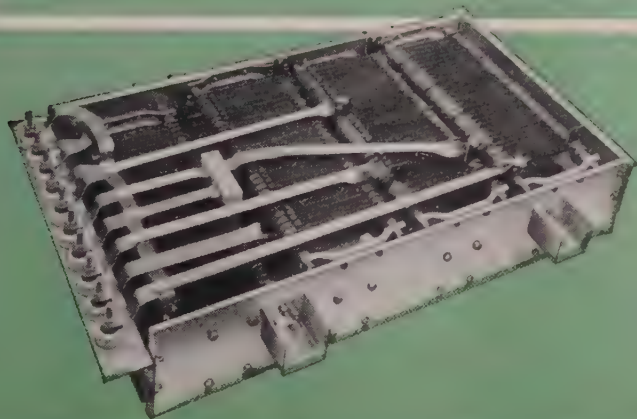
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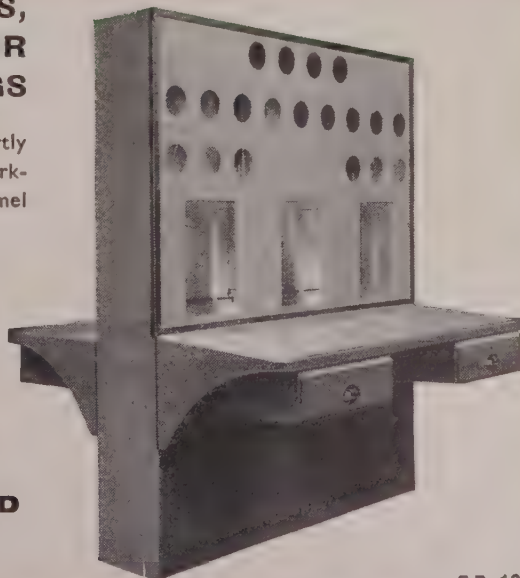
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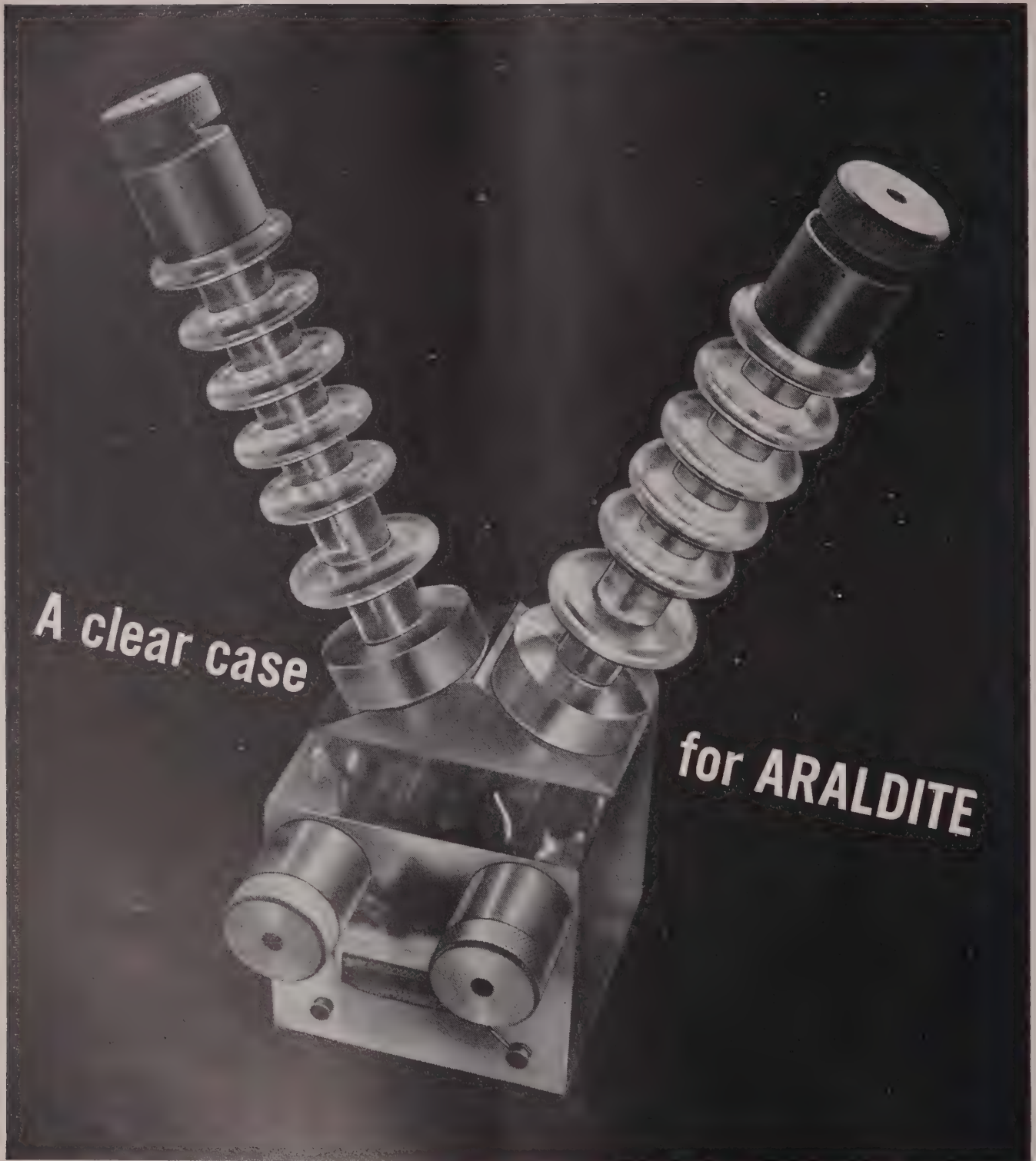
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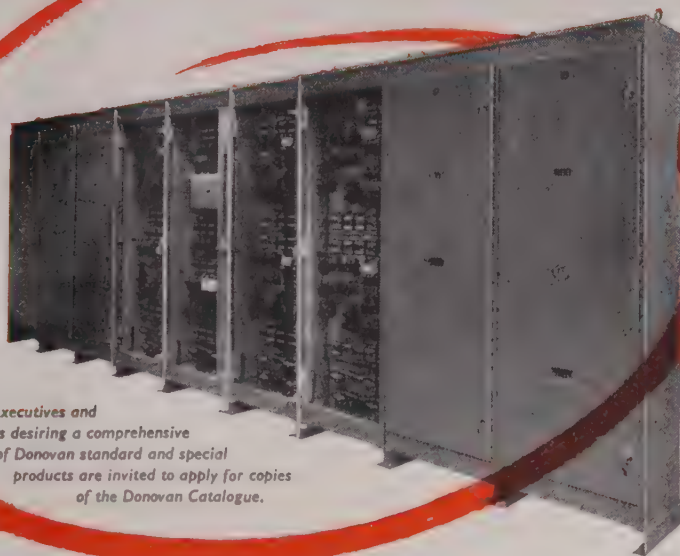
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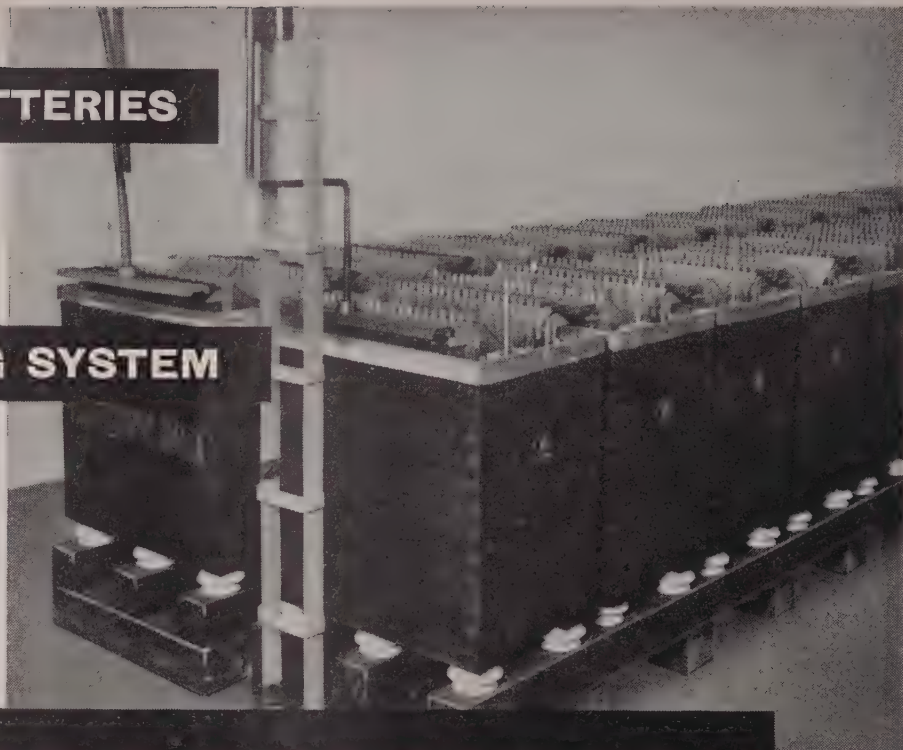
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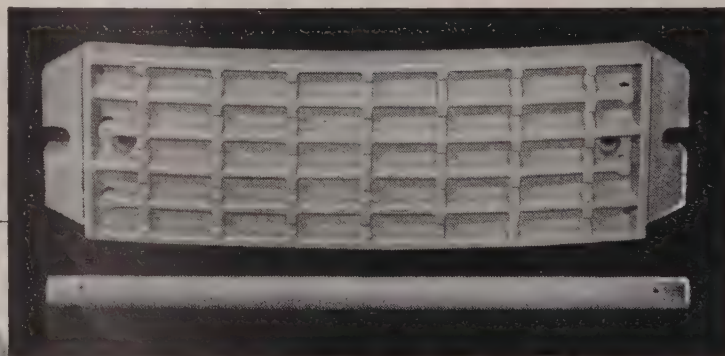
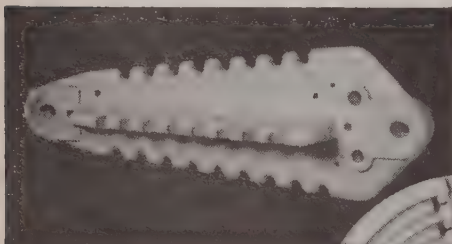


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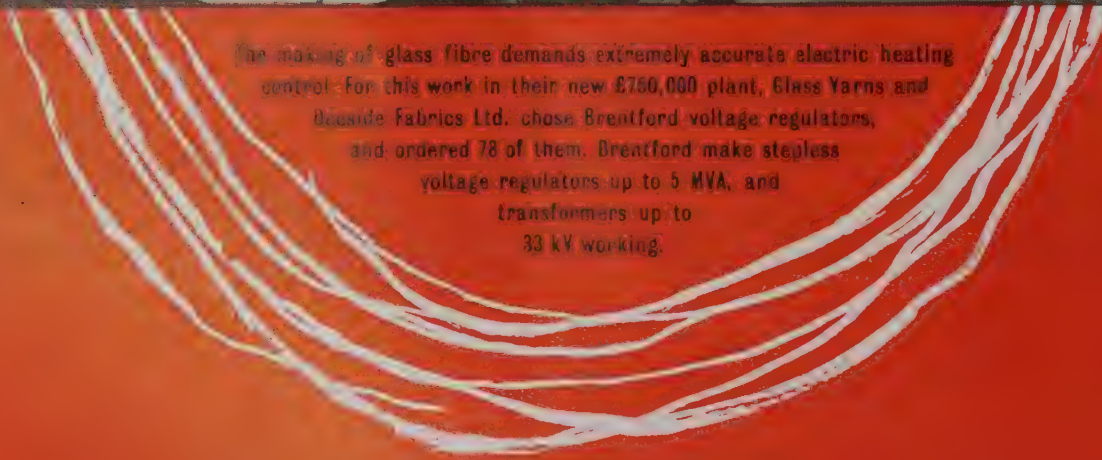
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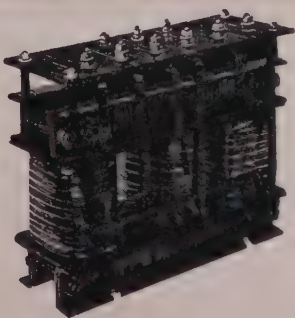
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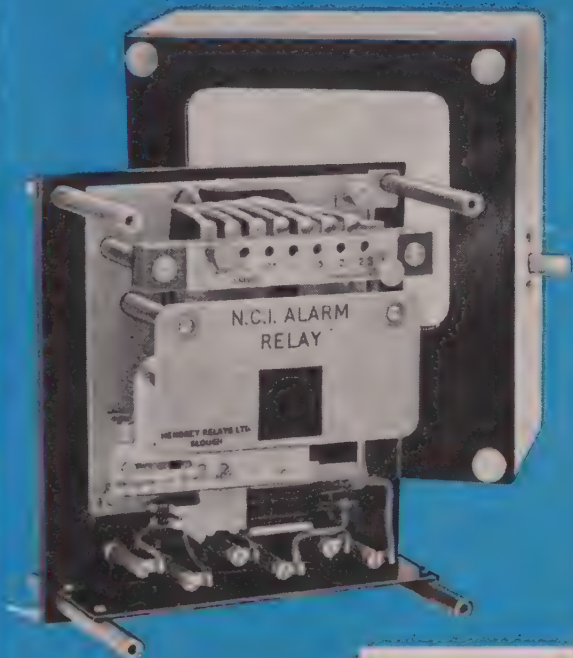
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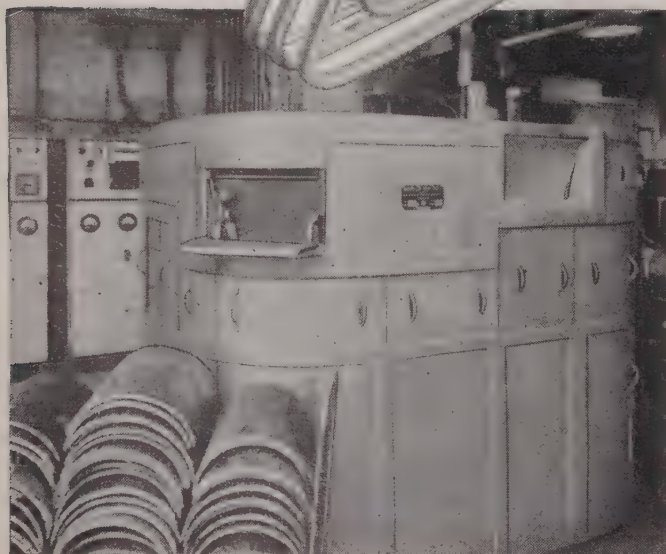
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ELECTRICAL REVIEW

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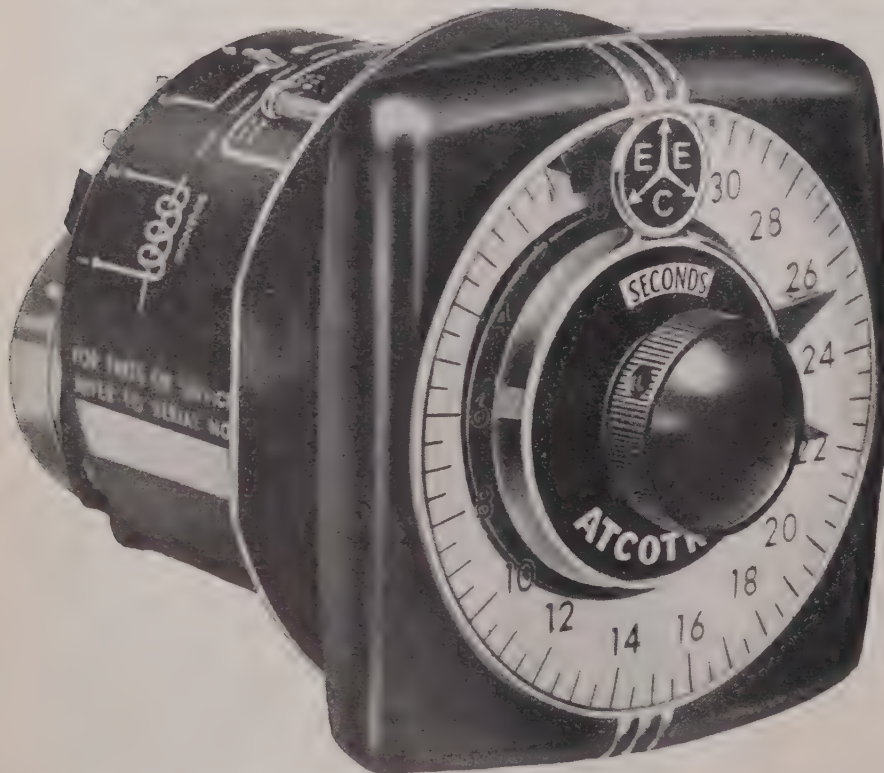
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ELECTRICAL REVIEW

3 February 1961 Vol. 168 No. 5 Established 1872

Revision of Standards

THE revision of British Standard 162 concerning electric power switchgear has just been published by the British Standards Institution and an article in the present issue marking this event will be of considerable interest to both users and manufacturers of switchgear. The revision contains many modifications of detail and some of major importance. The new treatment of electrical and safety clearances greatly affects the design of open type high voltage substations, being based on impulse voltage levels and the requirements of operational safety and convenience. The subject matter of the Standard has been widened and it now caters also for electrical and pneumatic auxiliary systems.

Inevitably, the publication of a comprehensive piece of standardisation work raises a number of questions. It may be asked whether justice is being done to the progress of the art or whether traditional treatment has been retained and is liable to encumber further development. The general answer in the present instance will be that the revision is generally progressive, but in some instances there may be a little doubt. Some provisions appear to be concerned with refinements and not with essentials.

This leads on to another important question, namely, whether, in view of the long time and the large effort it has taken to prepare the revision, there are any ways and means of easing and simplifying the preparatory work involved. There should not be any loss of essential value and perhaps there might be a gain in making British Standards more up-to-date by shortening the interval between revisions. Omission of some details would assist in this direction. Another way might be to separate out provisions which tend to recur in a number of Standards, such as definitions, service conditions, test voltages and clearances, and treat them in standards of their own which would become subsidiary to a number of other Standards. Some of the matter which now finds its way into appendices might be more appropriate for authoritative publication elsewhere and would thus not involve a multitude of engineers in their preparation.

Whilst we are justly proud of the high standing of British engineering reflected in British Standards, refinements will have to take second place in the preparation of international and Western European standards where different national traditions have to be reconciled. Close attention to the definitions of technical terms, which has been one of the features of the present revision, will bring results by leading to the use of one "language" though in different tongues.

ELECTRICAL MANUFACTURE IN EUROPE

The five largest markets for British electrical equipment, taking over a third of total electrical exports, are all in the Commonwealth. Manufacturers in this country have therefore had the advantage of dealing with customers who speak the same language and, perhaps more important, are by education and training largely in sympathy with British ideas and methods. These countries also have in common the less desirable distinction of being many thousands of miles away.

In contrast, the five largest markets for Western Germany's electrical exports, also accounting for over a third of the total, are all her near neighbours. They are all highly industrialised countries with their own engineering traditions. The success of Germany in the rapidly expanding European markets is to some extent a measure of the opportunities which British manufacturers have lost by too great a concentration on the easier, traditional outlets for their exports. However, moves towards integration in Europe, and even more the ability of Continental firms to sell in increasing quantities in this country, emphasise the scope which these markets on our doorstep offer for reciprocal trade. Since we believe that an important ingredient of success is a better understanding of the methods and outlook of our competitors we are starting on 17th February a series of articles on electrical manufacturing in Europe. In an introduction Mr. S. F. Steward, the director of the B.E.A.M.A., will describe the extent to which British and Continental electrical manufacturers are already working together to facilitate the free flow of trade.

LIVE LINE REPAIRS

Maintenance work on live overhead transmission lines has been carried out in the United States for over thirty years. With voltages up to 5 kV rubber gloves are used. At higher voltages, the work is done at safe distances with tools fixed on insulated rods, the lengths of which are dependent on the voltage concerned. It has been found that such "hot" line work is more economical and has caused fewer accidents than working with the supply disconnected. This is presumably due to the extra safety precautions taken and the careful planning that is required. In Britain, live line work is still under investigation and only recently have second lines been strung on a double-circuit system while the original circuit was alive.

Now, a new technique of working with bare hands has been field tested up to 380 kV and will be adopted as standard practice by one of the American power groups. With this method, the linesmen stand in a non-conducting fibreglass bucket supported by an insulated boom. The men are charged at line voltage by connecting the bucket's metal mesh lining to the live line, thus allowing them to work with bare hands in safety. The linesmen work with conventional tools, in comfort and without safety belts.

Live line work is of greater benefit where the trans-

mission system is mainly composed of radial lines; supplies would have to be disconnected if dead line maintenance were carried out. Most lines in Britain are connected into a network so that hot line work is not essential to maintenance of supplies. However, as ring circuits become fully loaded, the need for live line maintenance will increase.

NUCLEAR RATIONALISATION

After some delay, occasioned by the abortive merger discussions between the General Electric Co. and the English Electric Co., the plan to combine the activities of the G.E.C./Simon-Carves atomic energy group and Atomic Power Constructions, Ltd., are to proceed. As will be seen from the report on page 211 of this issue, the combination takes the form of a new company, the United Power Co., Ltd., in which the two consortia are equal partners. In order, as they say, to facilitate the merger, Crompton Parkinson, Ltd., who were original members of Atomic Power Constructions, have withdrawn from that concern. Also in the statement sent out on behalf of the new company no direct reference is made to the civil engineering or constructional companies which were associated with the two groups although, presumably, they will be concerned in future work undertaken by the United Power Co.

This measure of collaboration (or rationalisation) follows upon the recent coming-together of the Nuclear Power Plant Co. and A.E.I./John Thompson Nuclear Energy Co. a year ago. With the English Electric consortium, there will now be only three major atomic power groups to undertake the programme of one station a year envisaged by the Central Electricity Generating Board, and any overseas contracts which may be received.

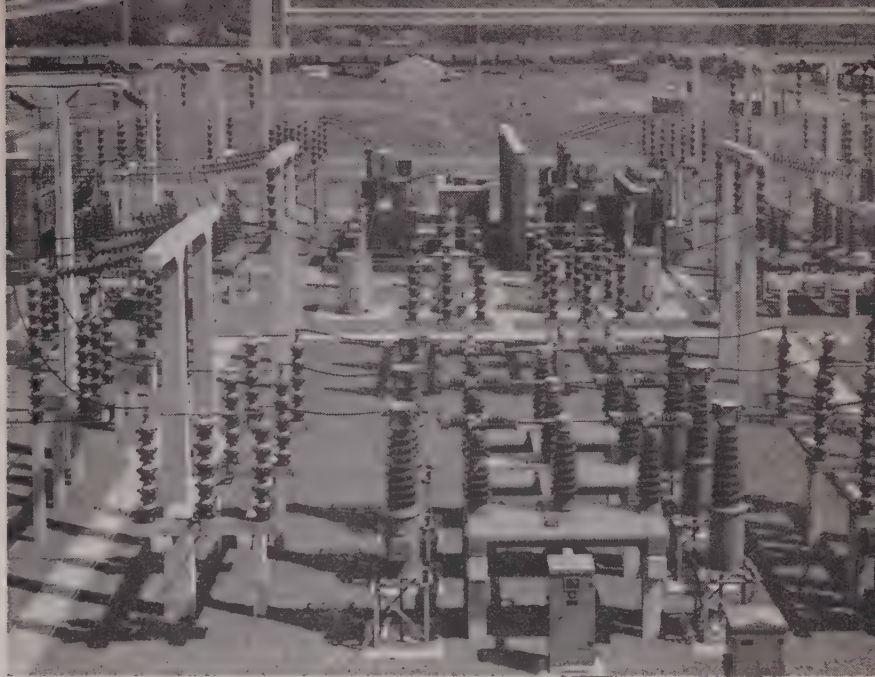
GAUGING THE DEMAND

Among the principal sufferers from the Board of Trade's abrupt "start-stop" way of introducing changes in hire-purchase regulations is the domestic refrigerator industry. The imposition of restrictions, coupled with a wretched summer, made 1960 a disappointing year for the industry. It must be said, however, that it was disappointing mainly because the rate of progress was retarded; the volume of business was comparable with that of the preceding year.

Refrigerator makers are victims not only of h.p. changes and climatic vagaries: they find it virtually impossible to assess prospective demands and adapt their production accordingly. They say that this arises from the lack of co-operation on the part of dealers. The makers do not know what stocks remain in the shops and dealers are apt to place their orders too close upon the beginning of the season. It was suggested at a press gathering last week (see page 212) that retailers' organisations should remedy these shortcomings, but this implies that dealers are properly organised. This, as we mentioned in a recent issue, is by no means the case.

An Introduction to the Revision of British Standard 162

The renewed importance of B.S. 162 can be detected from this critical appraisal of the latest revision, although the comment is concerned only with some more important and novel points. A number of new sections have been added since the latest revision in 1938. Dr. Maass was a member of the B.E.A.M.A. and B.S.I. committees concerned with the preparation of the revision



SWITCHGEAR STANDARDS

By Dr. H. F. MAASS, A.M.I.E.E.*

BBRITISH Standard 162: 1961 "Electric Power Switchgear and Associated Apparatus" is appearing 22 years after the publication of the previous version which was the second revision of the Standard, originally published in 1928. Even allowing for the intervention of the second world war, this is a long interval largely accounted for by the detailed consideration the revision has been given by interested committees of the British Standards Institution, Electricity Boards and switchgear manufacturers.

B.S. 162 occupies a unique place in British switchgear standards; it serves to co-ordinate requirements laid down in numerous Standards for individual switchgear apparatus, notably in B.S. 116 and 936 for oil circuit-breakers, B.S. 159 for busbars, B.S. 861 and 2631 for air- and oil-break switches, B.S. 3078 for isolators. The co-ordination concerns the relationship of individual apparatus in assemblies, connections between them and measures necessary to assure their safe and reliable operation in combination.

The primary purpose of British Standard Specifications being to clarify technical requirements between manufacturers and users, the Standard does not set out to cover safety requirements laid down by law, which vary between countries, or in individual user's safety rules. The foreword, however, draws attention to relevant statutory requirements in this country and some statements are included concerning the application of the Standard in the United Kingdom. This does not detract from its standing as a document of more universal application.

The scope of the Standard has been extended—as indicated by the reference in the title to "associated

apparatus"—by the inclusion of sections dealing with control, relay and metering boards and with auxiliary systems (electric and pneumatic).

Definitions

The number of definitions has more than doubled. Whilst introduced by the usual statement that they apply for the purpose of the Standard, the definitions will also serve to clarify switchgear terminology in general usage.

The Standard uses the term "switching device" in a wide sense not only for devices opening and closing circuits—circuit-breakers, switches and isolators—but also for fuses which have the more restricted function of opening a circuit under fault conditions only, and earthing devices.

The term "switchgear" comprises switching devices of all kinds, together with equipment having the related functions of controlling, measuring, protecting and regulating, connections linking the apparatus and the structures on which they are supported.

A helpful distinction is made between separate forms of exposure which switchgear may have to meet: electric surges and the weather. Frequently "electrically exposed" and "outdoor" conditions occur together, as do "electrically non-exposed" and "indoor." However, these conditions are not invariably so combined. Similarly one may tend to associate types of gear, for instance "open type" and "metal enclosed," with certain exposure conditions. However, different types of switchgear serve different operational conditions and essential safety in operation is provided for in various ways, with different space requirements and operational facilities.

Particular attention is given to metal-enclosed gear,

The illustration above shows a 132 kV outdoor station typifying the subject of one of the most important parts of the revised Standard. (Photo by courtesy of the South of Scotland Electricity Board)

* Consulting Electrical Engineer, Switchgear Division, Higher Openshaw, Associated Electrical Industries, Ltd.

one main differentiation being by the form of the isolation provided for circuit-breaker or switch: "fixed type" and "drawout type," another by the extent to which components are individually enclosed: "metalclad" and "cubicle." Metalclad switchgear being the most outstanding form in British practice, the kind of busbar insulation provided gives rise to the established adjectives of "air-insulated," "compound filled" and "oil filled" to which have been added "gas filled" and "bushing type."

The terms "panel" for a self-contained structure of apparatus, generally associated with one circuit, and "board" for an assemblage of panels, are now given distinctive meanings by the use of prefixes "switch" (this being the most comprehensive), "control," "metering," "relay" and "instrument."

A group of definitions covering electrical and safety clearances and the related conception of "work section" which supersedes the previous "section," are dealt with later in this article as the provisions for open type h.v. switchgear probably contain the most notable changes in the Standard.

Service Conditions

The standard conditions of system earthing, altitude, ambient temperature and atmospheric conditions appear in the form they have taken in recent Standards for switchgear apparatus and are in substance similar to those in Standards for other power equipment such as transformers and bushings. It would assist users of British Standards if complete alignment could be achieved.

Design and Construction

A short basic clause on "safety requirements" is followed by a list of "relevant British Standards," with which apparatus incorporated in switchgear shall comply "where applicable." New clauses on "mechanical strength" and "protection against vermin" provide for designs adequate for short-circuit and climatic conditions.

The clause concerning "Earthing or Insulation of Metal Work" to safeguard operators, has been much shortened, but is supplemented by an Appendix (D: "Recommendations for Earthing") which goes into detail, not only from the viewpoint of safety of personnel, but also that of plant.

Fundamental for the safety of personnel is the provision of an effective low impedance connection between any two points of the frame with which an operator may be in contact simultaneously, and the deflection of fault currents from this path. Occasionally these requirements may become a little contradictory. The safety of plant again involves reducing any potential differences in the earth system to the minimum compatible with economy. It is necessary to strike the right balance and the recommendations of the Appendix will repay close reading, being suitably sub-divided by types of switchgear, not omitting such aspects as measures necessary to assure lasting effectiveness of the earthing provisions made.

Users of the Standard may note the omission of a clause on protective "finish." This does not sanction inferior finishes of switchgear, but simply means that with modern developments in metal finishing it is no longer appropriate to lay down a standard kind of finish.

The principles applying to "locks and interlocks" are set out systematically starting with the fundamental one that interlocks should be preventive as distinct from corrective in operation. For example, operation of an isolator shall not be possible whilst the circuit-breaker in series with it is closed; it would not be satisfactory if operation of the isolator should cause the circuit-breaker to open. Circuit-breakers used for earthing duties are to be provided with locking facilities making mechanical and electrical tripping devices inoperative.

The connection of "voltage transformers" calls for the interposition of fuses, or other protective devices, on the primary side, with the reservation "wherever practicable"; this may be an acknowledgment of the good service record of voltage transformers which should make special protection unnecessary. The size of primary connections to voltage transformers is to be such as to safeguard them in all circumstances other than direct attack by a fault arc.

There has been an important change in the meaning of coloured signal lamps. The colours "red" and "green" now indicate the positions "closed" and "open" of the switching device. The function of "white" has been taken over by "amber" which has been given the extended significance of indicating abnormal conditions requiring action. White lamps now indicate healthy conditions.

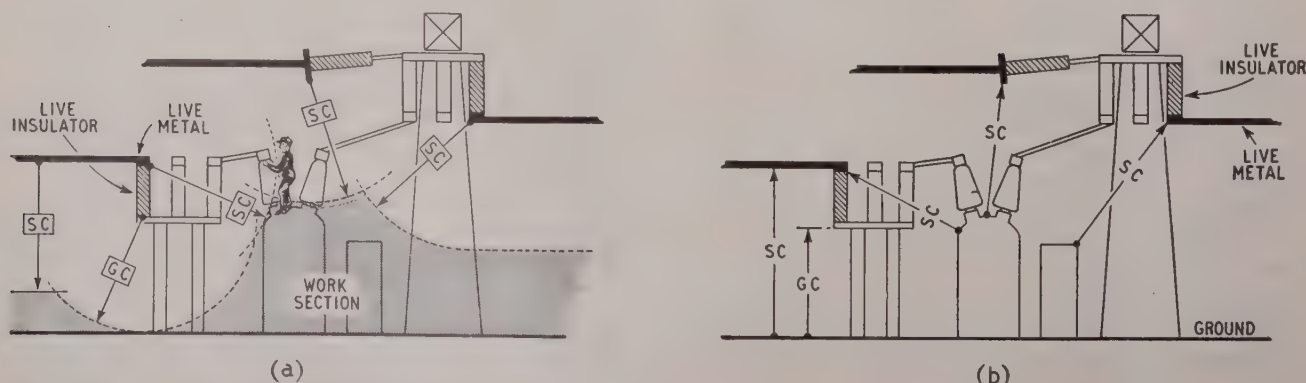


Fig. 1.—Safety clearances in maintenance work. (By courtesy of the British Standards Institution)

(a) Boundaries of temporary work section.

SC minimum section clearance specified.

GC minimum ground clearance specified.

(b) Illustration of clearance arrows.

SC distance not less than minimum section clearance specified.

GC distance not less than minimum ground clearance specified.

A new clause provides for the safety of earthing equipment during and after earthing of the main circuit.

L.V. and M.V. Open Type Equipment

The general clauses on design and construction just discussed, are supplemented by parts of the Specification concerned with particular types of gear; the first of these is for open type switchgear for voltages not exceeding 660 V. There are some detail changes in this part, which do not appear to call for special comment.

Metalclad and Cellular Type Switchgear

The subject matter of this part has been extended by the inclusion of low and medium voltages so that it now covers all metal-enclosed and cellular type switchgear. All live parts have to be enclosed in these types of gear and where insulating filling materials are used, these must be safely retained; a new hazard mentioned is loss of filling material by capillary action of small wiring. An additional set of requirements aims at assuring safety from any influences emanating from auxiliary equipment including small wiring, and is typical of the attention to detail in the revised Standard.

The "safety of access" provisions contain requirements similar to those contained in the clause "safety devices" previously included in the general part. Clear labelling and colour painting of shutters over spouts and isolating features is made mandatory.

Clearances and lengths of insulators in air for indoor switchgear are prescribed for rated voltages up to 33 kV; in the following part of the Standard, these are also made applicable to indoor open type gear of voltages below 22 kV and, if electrically non-exposed, for 22 and 33 kV. The values of clearances are generally unchanged in line with corresponding values in B.S. 116 : 1952; they apply in a similar manner.

A single clause now contains the special requirements for cellular-type gear.

A.C. High Voltage and E.H.V. Open Type Switchgear

Considerable changes have been made in the provisions for open type h.v. switchgear, where busbars and connections consist of bare conductors and apparatus is mounted on the ground or, an arrangement which has become common since the previous issue of the Standard, are supported above ground on pedestals or framework. The important difference between "electrical" and "safety" clearances is stressed.

Electrical clearances provide the insulation of live parts in air, necessary for satisfactory service. Two kinds of electrical clearance are now used; "earth clearance," the minimum distance required between any exposed live part and any part at earth potential, and "phase clearance," the minimum distance required between exposed live parts of different potential.

The values of electrical clearances outdoors are already familiar, being identical with those given in Tables 4-6 of B.S. 159: 1957 "Busbars." These clearances also apply indoors for voltages of 22 kV and above in electrically exposed conditions. Compared with the previous edition of the Standard, earth clearances have been increased by

approximately 10-30 per cent whilst phase clearances have been reduced by about 10 per cent compared with previous clearances between poles, but considerably increased compared with previous distances between conductors of the same phase which can be disconnected from each other.

Except for rated voltages below 22 kV, impulse voltage withstand levels form now the basis for the choice of electrical clearances. An Appendix (H) gives guidance on this subject and explains the derivation of the values tabulated. Top limits for earth clearances yielding the stated impulse levels were found by experiments with unfavourable electrode shapes. Values 10 per cent less than these limits are given in the body of the Standard, this reduction being justified in many cases by the protection level provided by surge divertors or co-ordinating gaps, the frequency of lightning and by electrode shapes being usually better than those tested. Where especially severe conditions exist, the top limit clearances may be used, but it is also admissible to reduce clearances for favourable electrode configurations provided the desired impulse levels are obtained. Tabulated phase clearances exceed earth clearances by 15 per cent, and a further safety margin, reducing the chance of flashovers between live parts, is generally obtained as these gaps tend to possess more favourable electrode configurations than those to earth.

Safety clearances ensure the safety of personnel working in an open type switching station. The term "safety clearance" is new in the revised Standard and covers two kinds of clearance. The more important of these, the "section clearance" is the minimum distance required between any unscreened exposed live part and any position to which personnel have access. The second, the minimum distance required between any unscreened exposed part of an insulator and any position to which personnel have access, is termed "ground clearance" because, as a rule, this clearance warrants special attention only when taken to positions on the ground. Where an earth screen is interposed, safety clearances are taken as taut string measurements around the edge of the screen.

The whole of the positions of access is termed "work section" signifying the space where a person may work in safety as long as part of his body remains in that space. Permanently available work sections allow access for operation and inspection. Work sections are temporarily extended when maintenance work is undertaken; this necessarily involves making dead at least part of the exposed conductors.

Section clearances were, in the 1938 edition, equal to 8ft plus earth clearances then prescribed. Evidently, experience has been satisfactory and it has not been necessary to increase section clearances in line with the increased earth clearances. A few inches has been added giving round values. The newly introduced ground clearance is given as 8ft for all voltages, this being taken as the "reach" in any direction of an operator not using special tools.

The Standard provides the basis only for applying safety clearances to the arrangement of apparatus and connections, the provision of points of isolation and facilities for earthing and for permanent and temporary means of access. A knowledge of operational requirements and of the occupier's safety rules is also essential. Whilst this is fully recognised, the Standard includes the

general requirements which govern access for operational purposes, access for maintenance work and restriction of access of unauthorised persons. These requirements are enlarged upon in three Appendices (B: "Notes on the Provision of Safety Clearances and Work Sections," C: "Delimitation of Work Sections—with Special Regard to Conditions in the U.K.," and K: "Figures and Schedules to Illustrate the Principles Involved in Applying Safety Clearances in the Design of Switching Stations").

A main problem in laying out a substation is to achieve safety during maintenance work without inordinately interfering with service. Figs. 1a and 1b show two methods which can be used to check safety provisions on the drawing board, a most important point when it is remembered that once gear is live it is not practicable to check clearance distances directly. In Fig. 1a the limits of a work section given by the prescribed safety clearances are indicated for a circuit-breaker which has been isolated from the system by opening both its associated isolators. The same arrangement is shown in Fig. 1b and clearance arrows are drawn from positions of access required for work. The latter method is a more convenient way of showing in a layout drawing that clearances are not less than required; it has been adopted for the five layouts illustrated in Appendix K as it allows indicating a number of different maintenance situations in each layout drawing. No doubt these drawings will find much attention in drawing offices and the B.S.I. is making large-scale versions available.

Switchgear in Kiosks

The additional requirements for switchgear in kiosks refer now specifically to the two hazards of condensation

and entry of vermin; ventilating and other apertures must not permit the insertion of a $\frac{1}{8}$ in diameter rod.

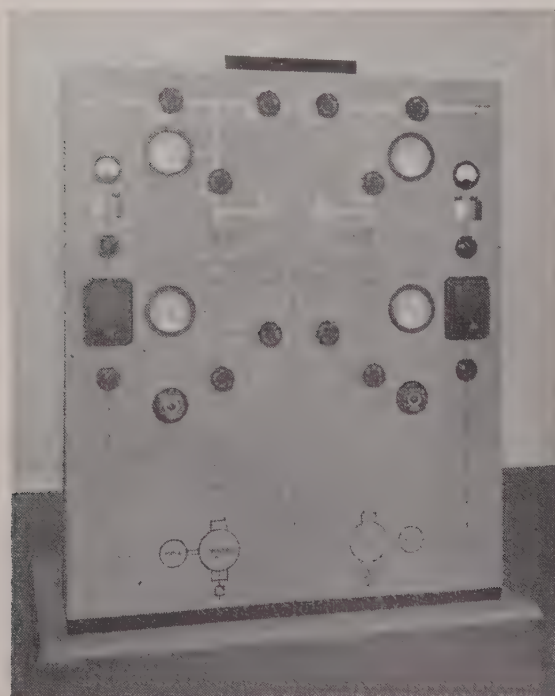
Control, Metering and Relay Equipment

This new part of the Standard contains a few short clauses concerned with safe and convenient access to relays and other apparatus, direction of rotation and distinctive shape of control switch handles for operating circuit-breakers, and rationalisation of colours used for finishes and for the identification of fuse and isolating links.

Auxiliary Systems

A further new part of the revised Standard covers auxiliary systems. The requirements for auxiliary electrical systems include provisions for standard voltages and choice of the capacity of batteries and rectifiers. This is a welcome clarification, being a necessary corollary to the operating voltage ranges specified in circuit-breaker Standards, a matter of particular practical importance for high-power closing solenoids.

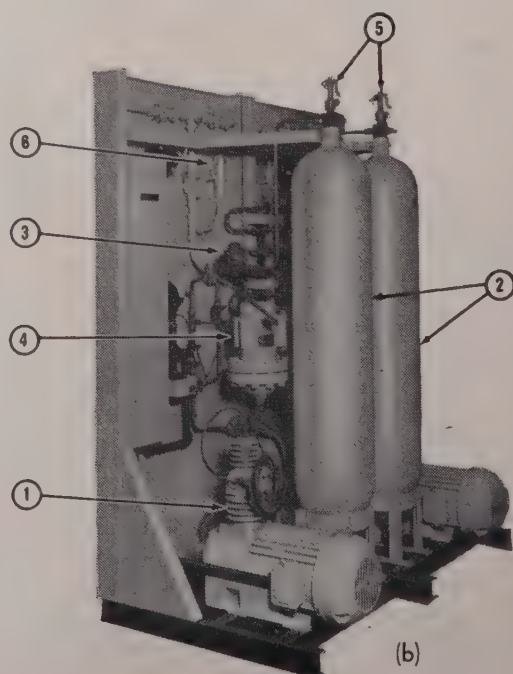
For such high-power applications, pneumatic operation is now frequently employed in this country, though it is not equally popular for low-power applications, where it is common in some Continental countries. The requirements of auxiliary air systems cover these applications and also the use of compressed air in air-blast circuit-breakers, as a quenching medium and for air conditioning internal insulation surfaces. Dry and clean compressed air is particularly important for the latter application. Either a "common air supply," the rule with air-blast circuit-breaker installations, or a "unit air supply" to operate an individual piece of switchgear equipment is used. Air systems are inherently fairly elaborate, requiring, apart from compressors, receivers and pipework, a number of valves and other devices to ensure a safe supply of a sufficient quantity of clean compressed air. In spite of this elaboration, neat and compact arrangements can be produced which assist safe operation by the mimic diagram form in which the controls are set (Figs. 2a and 2b).



(a)

Fig. 2.—Duplicate common air supply system for oil circuit-breaker closing. (By courtesy of A.E.I., Ltd.)

- a) Front view: Controls in mimic diagram form.
 (b) Rear view: (1) Motor compressors. (2) Air receivers. (3) Pressure reducing valves. (4) Oil and water separator. (5) High pressure safety valves. (6) Low pressure safety valves.



(b)

The Standard deals with the requirements in a clause which goes already into fair detail and is supplemented by notes in an Appendix (J). This appendix includes advice also on the two-pressure air system which is the most commonly used method of drying compressed air. Arrangements of air receivers and supply pipeline systems are discussed with the aid of diagrams.

Tests

The only kind of tests included are routine ones. As to voltage tests at the manufacturers' works and on site, the changes from the previous issue are not of great importance and the treatment is already known from Standards for switchgear apparatus published in recent years, for example B.S. 3078. New are tests to assure that compressed air systems are free from excessive leakage and otherwise operate correctly.

It is accepted that routine voltage tests on the completed switchgear may not always be practicable and as to type tests, reliance is placed on the type test requirements

for individual apparatus; these ensure that apparatus are tested in representative arrangements and with representative connections.

Appendices

The Standard has now 10 appendices of which six have already been referred to under previous headings. The previous issue had five appendices. Appendix A: "Information to be Given with Enquiry or Order" is fairly short for a Standard dealing with such a variety of gear, but contains essential headings. The appendix regarding "Slab Sizes" has disappeared and that on "Service Conditions" is now covered in the body of the Standard. The remaining new appendices E, F, G have the headings "Insulation Co-ordination," "Selection of Rated Voltage" and "Local Atmospheric and Climatic Conditions." The last-mentioned refers to the possible use of heaters and the need for cleaning insulation in a regular fashion to combat the old enemy of electrical insulation, surface deposition and ingress of moisture.

Nuclear Power in Sweden

FROM A CORRESPONDENT

The Swedish atomic energy programme is based on pressurised heavy-water moderated and cooled, natural uranium reactors. Two such power reactors, rated at 65 and 100 MW, are under construction and are due for completion in 1962 and 1967, respectively. By 1964, Sweden will be producing 120 tons of indigenous uranium per annum. The facilities at the Swedish nuclear research centre are described

ALTHOUGH almost entirely lacking in fossil fuel deposits, Sweden is rich both in developed and potential water power. Hydro power covers most of Sweden's need for electricity (increasing by approximately 6.5 per cent annually) and it is expected that further hydro-electric development will be able to meet demand throughout the 1960's. However, about 66 per cent of the country's total energy needs (rising by an estimated 4 per cent annually) has to be met by fuel imports. These imports of fossil fuels amount to almost 20 per cent of the country's total import value.

The Swedish atomic energy programme aims at providing the country with reactor types competitive with conventional power stations so that the increasing dependence on the import of fossil fuels will be checked. The exploitable water power reserves are likely to be exhausted in Sweden in the 1970's and attention is naturally focused on the possibilities of utilising the considerable domestic resources of natural uranium.

R3/Adam Reactor

The first reactor plans are aimed primarily at the supply of district heating. One reactor was to be built near Stockholm for both heating and power production, and another, for heat only, at Västerås in central Sweden.

These plans were later modified and the two projects were combined. The combined power-heat station, R3/Adam, is now being constructed at Agesta, a few kilometres south of Stockholm. During its initial operational period the reactor will have a thermal power of 65 MW and 10 MW of electricity will be generated in a back-pressure turbine. About 55 MW of heat will be delivered for district heating purposes. The output will later be doubled through the addition of further heat exchangers. The R3/Adam reactor will be of the pressurised, heavy-water moderated and cooled type. Its fuel will be natural uranium oxide canned in "Zircalloy," and it is expected to provide heating for more than 10,000 homes in a newly-built suburb of Stockholm. Construction started in November, 1957, and the station is planned to go critical in 1962.

The Swedish Atomic Energy Co. is responsible for the design and construction of the reactor, and the State Power Board for the remaining parts of the reactor station. The main contractor for the reactor is Allmänna Svenska Aktiebolaget (ASEA). The Stockholm Electricity Board will build and pay for the turbo-generator and for the district heating network. The reactor station is built in an underground chamber blasted out of rock.

The first Swedish power reactor, R3/Adam, is not expected to become economically competitive. It will,

however, give valuable experience for future reactors of the heavy-water type and is thus an important step in the development of power stations for electricity production only, and particularly for the next step in the Swedish programme, R4/Eva.

R4/Eva Reactor

The other reactor project for which funds have been appropriated has been called Eva and is designed exclusively for the generation of electricity. It will be situated in central Sweden and will have a capacity of 100 MW. Basically of the same type as R3/Adam, it is planned to be completed in 1967. The Eva power station will also be built by the State Power Board, with the Atomic Energy Co. responsible for its design. Private industrial groups have undertaken construction and engineering work.

Foreign Reactor Proposal

The Swedish power industry is considering the building of an additional nuclear power plant based on an imported reactor, to be operated from 1965. The arguments in favour of this project are that it is desirable for the power industry to acquire constructional and operational experience before the R4/Eva reactor is completed. However, no definite decision in the matter has yet been taken; limited resources of technical personnel are the main reason for very careful consideration before a new system is introduced parallel to the natural uranium heavy-water type.

Uranium Resources

Large deposits of shales in central Sweden contain uranium, and a small extraction plant has been in operation since 1953. The present output is approximately 10 tons per year. A bigger plant with an estimated annual output of 120 tons is under construction. It is planned to be in operation by 1964 and should be able to meet Swedish needs in the 1960's. One of the main reasons for having the present Swedish reactor programme based on natural uranium is, of course, the existence of such material in the country. The refining of uranium concentrate and the manufacture of fuel elements is done by the Atomic Energy Co. in Stockholm.

The Swedish reactor programme has so far followed a strictly national line, centred round the natural uranium, heavy-water reactor type, but development abroad is being watched closely. Sweden cannot afford to develop a variety of reactors, and available opportunities for collaboration in international programmes have therefore been seized, as for example in the O.E.E.C. projects concerning the boiling heavy-water reactor at Halden, Norway, and the high-temperature gas-cooled reactor at Winfrith Heath, United Kingdom.

Research

Most research work is now being done by the new research centre of the Atomic Energy Co. at Studsvik, about 60 miles south of Stockholm. However, the company's first research reactor R1 (1 MW) has been in operation since 1954 in Stockholm, where a zero energy reactor assembly, ZEBRA, has also been used for experiments since 1955. In addition to company headquarters, the following facilities have been set up in Stockholm:

physics and chemistry laboratories, a refinery plant for uranium and uranium dioxide and a fuel element factory. It is intended, however, to move the main part of the research and development work to Studsvik.

The most important facilities at Studsvik include a 30 MW materials testing and research reactor, R2, purchased from the U.S.A., a laboratory for active metallurgy and an isotope centre, a zero power reactor, Ro, and also a laboratory for radiation protection and waste disposal.

The ZEBRA installation has now been moved from Stockholm to Studsvik and a pressurised ZEBRA facility is under construction. In this, work will be carried out with the moderator under pressure.

A 5.5 MeV van de Graaff generator purchased from the U.S.A. will be used for physics experiments and fast neutron studies. A fast zero power reactor, FR-0, is being designed and will probably be housed in a building adjacent to the Ro laboratory.

The testing and research reactor R2 went critical in May, 1960. The total cost of this facility is estimated to be about 32 million Swedish Kronor, including reactor hall and auxiliary equipment. R2 is a modified pool-type reactor, in which the reactor core is enclosed in a tank which in turn is placed in a water-filled pool. All handling of radioactive materials can thus be carried out utilising the water as a radiation shield. R2 is primarily a research facility for reactor fuel development, but it will also be used in nuclear physics research and isotope production.

The maximum reactor power is 30 MW at which the thermal neutron flux in the centre of the core reaches about 2.4×10^{14} n/cm²/sec. The core is built up of fuel elements consisting of aluminium-clad uranium plates (MTR-type elements). In this case highly enriched uranium is used (90/U-235).

Five large vertical test loops, in which the high neutron flux can be utilised, run through the reactor core. In addition there are several small diameter vertical experimental channels in and around the core for irradiation of small samples and also about ten horizontal channels leading up to the core and intended for various types of experiments.

Testing Intrinsically Safe Apparatus

THE official testing in respect of intrinsic safety of apparatus for use in mines subject to the Coal Mines Act and premises to which the Factories Act, 1937, applies is covered by a revised edition of Testing Memorandum No. 10 "Test and Certification of Intrinsically Safe Electrical Apparatus and Circuits" recently published by the Ministry of Power (H.M. Stationery Office, price 1s).

This 15-page booklet opens with a definition of intrinsic safety and describes the requirements for any apparatus or circuit to be certified as intrinsically safe. This is followed by a section dealing with the procedure when applying for test and the conditions of certification. A number of appendices are included giving notes on the principles of intrinsic safety, listing the gases and vapours covered by the certificates of intrinsic safety, the tests which are carried out for certification and the conditions for certifying transformers for bell-signalling circuits constructed in accordance with B.S. 1538. In addition there are notes on the registration of trade customers, the information required with the application for a test and the scale of fees and the apparatus required for the test.

VIEWS on the NEWS

By "REFLECTOR"

MANY people in mining areas will not be convinced that electricity is not a rival to coal and that the electricity supply industry is the National Coal Board's best customer. In Stirlingshire electric floor warming has been installed in schools and the question of whether projected schools should have this or coal-fired heating was recently discussed by the County Education Committee when the apparent turning away from the use of coal was described as a "suicidal policy." One member alleged that the heating bill at a school with floor warming was £1,000 a year more than at a coal-heated school. This was countered by another member who said that costs in his all-electric house compared very favourably with the cost of coal. A third member said that miners in all-electric flats in Kirkcaldy found their costs were lower than if they were in houses where they could use the cheaper coal available to them. A report on the subject is being prepared for the Committee; it will be interesting to see what it says.

* * *

Indignation is expressed in the *Surrey Comet* at London Transport's decision to sell to Spain 88 of the 127 post-war trolley-buses operating from the Fulwell (Middlesex) depot and replace them by pre-war trolley vehicles from abandoned routes elsewhere in the London area. The reason given is that if London Transport had waited until next year, when the trolley-bus services are to be discontinued, they would have lost the chance of selling these vehicles. I am still of the opinion that the replacement of trolley-buses, which have given passengers every satisfaction, by oil-engined buses is not a good move and that Spain is not so backward after all if it chooses this form of transport.

In this connection, I see that the Stoke Newington Council has been asked by its General Purposes Committee to protest against the replacement of trolley-buses by oil-engined buses, because of the latter's dependence on imported fuel and the injurious fumes they produce.

* * *

Michael Faraday held decided views on the art of lecturing and demonstrating which he expressed in letters to his friend Benjamin Abbott. The Royal Institution, which Faraday served for so many years, has thought it fitting to reproduce his advice to lecturers and it must be said that it was worth doing. Faraday insisted upon calmness and naturalness, clarity of thought and diction, and reasonable length. He went into some detail in describing how the lecturer should stand and move and

generally conduct himself. Some of it reads like counsel of perfection, but the evidence of contemporaries shows that Faraday attained something like perfection as a lecturer. Dr. Bence Jones, secretary of the Royal Institution from 1860 to 1873, said that "his manner was so natural that the thought of any art in his lecturing never occurred to anyone." Copies of Faraday's "Advice to a Lecturer" are available from the Royal Institution at 2s 6d each.

* * *

In a letter to the *Gloucestershire Echo*, a correspondent rightly warns inexperienced people not to meddle with electrical installations. To point a moral and adorn his tale he mentions how experts go about jointing a cable in a hole in the road:—

"They never take chances and they always stand on a rubber mat. You attempt to touch them, or pass an iron tool to them while you are standing on bare earth, and 'sparks' will come off the joiner's tongue in no uncertain manner."

* * *

Reuter reported from New York last week that through a "stuttering" computer some clients of a New York brokerage firm each received two dividend cheques instead of one. A spokesman of the firm said that accidentally the taped information fed to the computer went through twice. But, he added, "any clients who cashed duplicate cheques will have the amount docked from their future dividends," so that they will not profit by the machine's over-enthusiasm.

* * *

A lecture given at the Royal United Service Institution by R. E. Crompton eighty years ago dealt mainly with recent improvements in lighting. In the course of his remarks, Mr. Crompton suggested that too much credit had been given to Edison, when the pioneer work on carbon filament lamps had been done by Swan and his colleagues. The report appearing in the *Electrical Review* of 1st February, 1881, concluded thus:—

"In the discussion that ensued, Mr. Lane-Fox defended Mr. Edison against the disparaging remarks the lecturer had made. Mr. Crompton was about to reply, when the chairman intimated that at that institution any matter of controversy was strictly excluded. Several questions were asked and replied to by the lecturer, and the company separated."

OIL PRESERVATION SYSTEMS

THE most generally adopted systems of oil preservation for large high-voltage power transformers have been the oil conservator in which the oil level surface is at constant atmospheric pressure, and the gas pressure system in which the upper part of the transformer tank is maintained under a positive gas pressure. This pressure is allowed to vary up to approximately 8 p.s.i. as oil volume varies with temperature. Both systems have given apparently satisfactory service for many years. With the use of still higher transmission voltages and larger capacity and more complex insulation structures, instances of service troubles in constructions involving the gas pressure system have focused attention on the danger of corona or flashover problems resulting from gas inclusions caused by gas bubble emission from oil when subjected to pressure variation. Suspected corona effects have been found on several transformers dismantled and examined following field service.

Previously published contributions^{1,2,3} have dealt with the phenomenon of bubble emission from supersaturated oil resulting from varying gas pressure at the oil surface. They have described how, due to the condition of instability when supersaturated, gas release in the form

Gas pressure oil preservation systems for transformers have given apparently satisfactory service for many years. With the use of higher voltages and larger capacity units, corona or flashover problems resulting from gas bubble emission from oil undergoing pressure variation have been experienced. This article, based on a paper presented to the American Institute of Electrical Engineers, describes the release of gas bubbles from supersaturated oil due to dielectric stress

formers using conservators with constant oil surface pressure are stated.

Suspected Corona Effects After Field Service

In the course of dismantling the windings of the transformers referred to above, areas of a dark brown staining were found on the paper lapping on some of the h.v. coil elements and on the inner edges of the coils adjacent to the main h.v. to l.v. insulation in the region near the line terminal coil. Also, bright clean areas were found on the conductors in the vicinity of the staining. This is illustrated in Figs. 1 and 2. The h.v. coil elements are assembled to fit closely over the main h.v./l.v. insulation tube. There inevitably exist certain small oil spaces in the vicinity of the coil, between coils, and between coils and main insulation. It was surmised that corona across

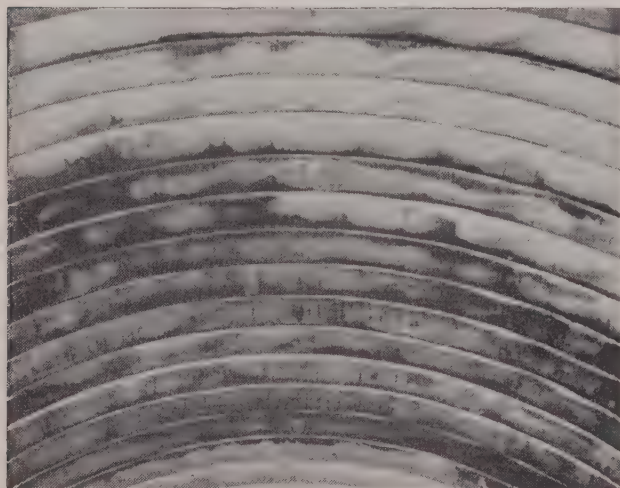


Fig. 1.—Areas of staining on inner periphery of h.v. disc coils

of bubbles is caused by violent agitation resulting from oil pump operation, or by the vibration of core limbs or tank walls. This article describes how gas bubbles are also found to be released from supersaturated oil as a direct effect of dielectric stress across an oil space.

Results are given of tests with models designed to simulate conditions where small oil spaces occur in insulation structures, showing bubble formation under stress and the chemical effects of corona across a gas space in the presence of oil and copper. In addition, results are given of corona measurements on gas pressure system transformers in operation at 60 c/s voltages up to 115 per cent of the normal service voltage, both in the laboratory and in the field. Also field results on trans-

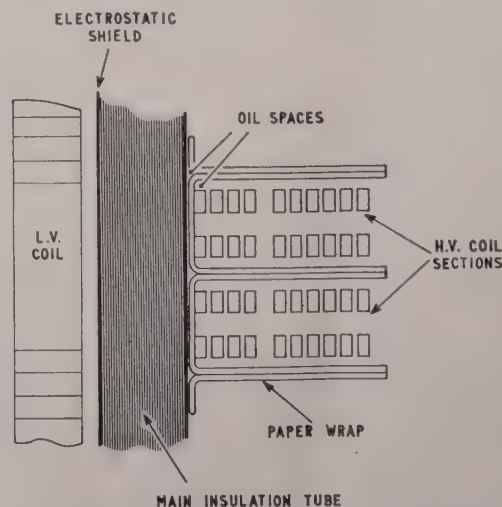


Fig. 2.—Part section of coils showing oil spaces where, if gas is present, corona could be set up

Factors Affecting Ionisation in Large Transformers

By A. T. CHADWICK, M.I.E.E., D. H. RYDER, B.Sc.(Hons.), A.M.I.E.E., M.A.I.E.E., and A. E. BRIERLEY, B.Sc.(Hons.), Grad.I.E.E.*

these small spaces might have produced the staining. From calculations it was evident that initiation of corona in these spaces could only occur on the assumption of the presence of gas instead of oil, as the stress at these points was far below the ionisation level of an oil dielectric.

The staining was of the nature of a deposit on the paper surfaces. Chemical investigation of the stain material and the conditions under which it developed suggested the following sequence of events. Ionisation of nitrogen gas bubbles trapped in spaces in the insulation, followed by chemical combination of ionised nitrogen with activated oil molecules, form amine type compounds. These amine compounds are capable of dissolving copper compounds (such as copper sulphide) which are invariably present on the surfaces of nearby copper conductors, and produce the bright clean areas on the copper surface. These amines plus the dissolved copper compounds diffuse through the oil away from the conductors. As the amines become diluted with more oil, their ability to hold the copper compounds in solution is reduced, allowing precipitation to occur, and small particles of the material build up to form the areas of staining.

Gas Emission Due to Dielectric Stress

As this theory of the cause of the copper sulphide deposits requires an initial space or pocket of nitrogen gas, it was decided to investigate the possibility of gas being released from supersaturated oil under the influence of dielectric stresses. Tests were made in a "Perspex" tank to allow observation. Spherical electrodes $\frac{1}{2}$ in in diameter and 2 mm apart were carried in a "Perspex" frame under oil in the tank. Eight sheets of 0.005in paper were placed between the spheres to further simulate conditions in transformer insulation. Inverted funnels were placed over the electrodes for collection and indication of the amount of gas evolved and nitrogen occupied the space above the oil in the tank. The general construction is shown in Fig. 3.

A test cycle consisted of applying a nitrogen pressure of 7 p.s.i. to the top gas space for several days—during which the gas content of the oil approximated to that degree of supersaturation corresponding to the pressure, viz. 12 per cent—energising the spheres at 10 kV and maintaining this during the remainder of the test, then reducing the nitrogen pressure at the top to $\frac{1}{2}$ p.s.i. Some time after this, usually between 20 and 40 minutes, a stream of bubbles began evolving from the space immediately between the electrodes, these being retained in the inverted funnels.

Typical curves from tests taken after the reduction of

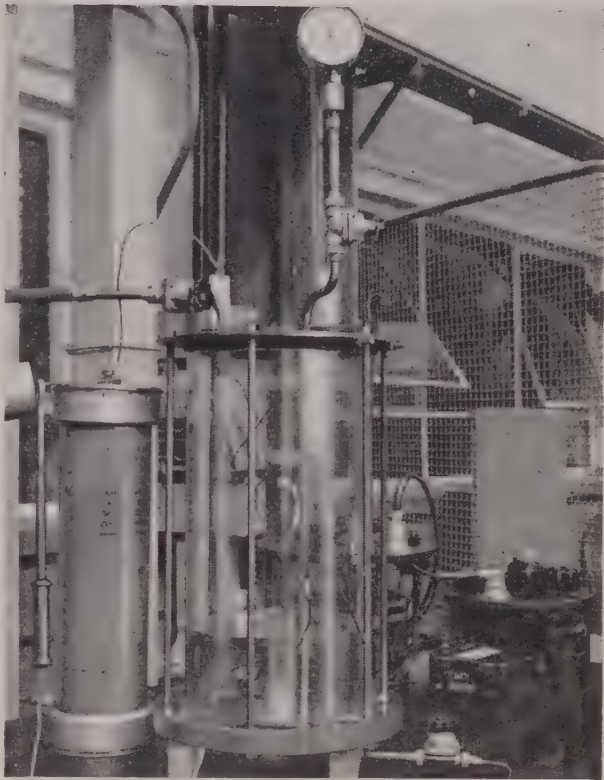


Fig. 3.—"Perspex" cylinder containing test models and pressurised with nitrogen

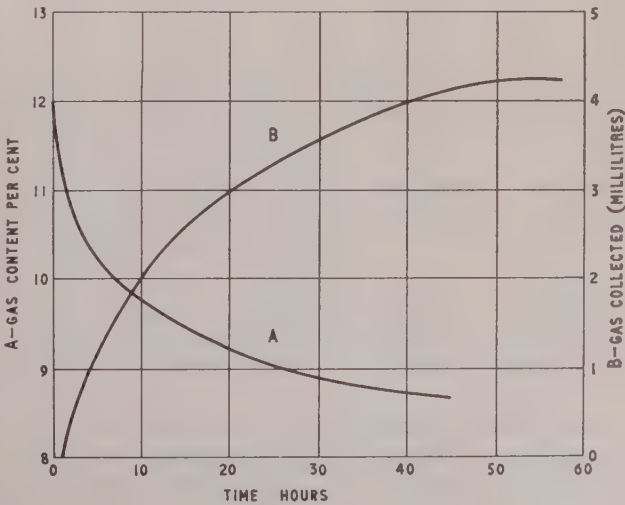


Fig. 4.—Results of tests on the release of gas from supersaturated oil after the reduction of the nitrogen pressure showing (A) the reduction of gas content of the oil and (B) the quantity of gas collected, after surface pressure reduction from 7 p.s.i. to 0.5 p.s.i.

*English Electric Co., Ltd.

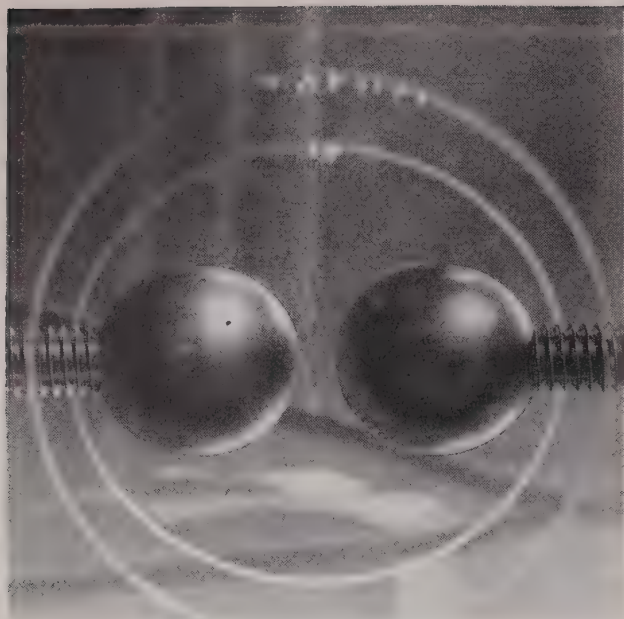


Fig. 5.—Gas evolution from oil-immersed electrodes under electrical stress when the oil is supersaturated

the nitrogen pressure are shown in Fig. 4, indicating the reduction of nitrogen content of the oil (A) and the quantity of gas collected (B), against time. Fig. 5 shows the evolution of gas from the electrodes in a test series where no additional paper insulation was placed between the spheres. It would appear from the tests that dielectric stress coupled with the degree of supersaturation corresponding to a surface pressure of 2 p.s.i. or more can give rise to bubble emission.

Corona in a Partially Gas-Filled Pocket

From these tests it was clear that a gas could be liberated from a supersaturated oil in small spaces in the stress regions of the insulation structure, which would tend to produce pockets of gas which could be trapped and initiate corona. Further laboratory tests were made to simulate this condition and if possible reproduce the copper sulphide deposits found in the service transformers. Models were used constructed from "Perspex." Each had a cavity in which were two flat-disc copper electrodes set 2 mm apart, see Fig. 6. Eight sheets of dried and oil-impregnated 0.005 in thick paper were placed between electrodes and located by a groove in the top of the cavity. The models were placed in a "Perspex" tank filled with oil, and nitrogen bubbles were introduced into the cavity sufficient to keep the oil level in the cavity approximately half-way up the electrode discs.

Voltage was applied between the electrodes until discharging occurred in the nitrogen space. The discharge produced a "shimmering" appearance of the oil film around the space. With a discharge detector in circuit, it was confirmed that the initial appearance of the shimmering coincided exactly with the detector indication.

A voltage of 8.5 kV was applied continuously for a period of 42 days, frequent observations being made to confirm continuance of corona discharge. The papers were then removed from the cavity and chemically examined. Amine compounds were found to exist over

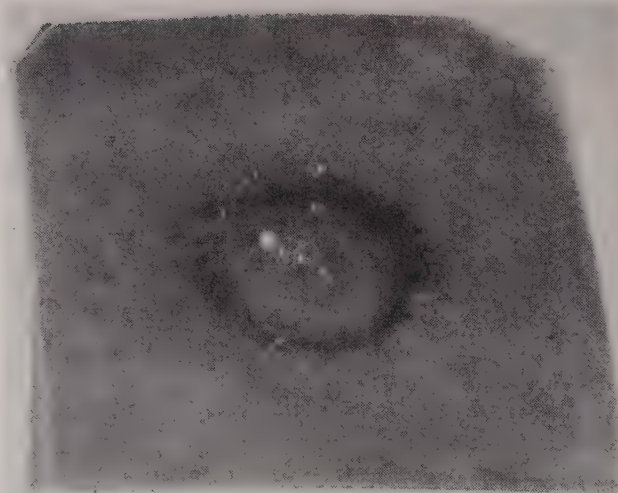


Fig. 7.—Copper compounds and "X" wax deposited on a paper adjacent to an electrode

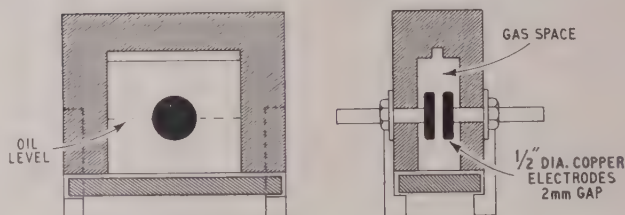


Fig. 6.—Model in which nitrogen bubbles, oil and paper were put under electrical stress, demonstrating the effect of prolonged corona

each of the eight pieces, and copper compounds (copper oxides and sulphide) on the side and across the edges of the papers which had been adjacent to the electrodes. Minute quantities of "X" wax were also found on the paper, this deposit being the result of the breaking down and recombination of some of the oil molecules. Fig. 7 shows the surface of a paper adjacent to an electrode. The copper compounds show as dark areas forming a circle approximating to the electrode disc shape, whilst the "X" wax can be seen only as scattered white specks by the light reflected from it. Bright clean areas appeared on the surface of the disc electrodes indicating the action of the amine compounds in removing the oxide and sulphide surface film.

Corona Measurements

It was thought that corona measurements made to N.E.M.A. Spec. 107 should constitute a means of direct comparison of the dielectric conditions in a transformer when subjected to a varying degree of vacuum during oil filling and the later application of surface gas pressure sufficient to produce supersaturation. Laboratory tests were made on two 103 MVA, 220 kV single-phase transformers. In the first instance one transformer was filled under a vacuum of 50 mm of mercury, and left to stand seven days. With 115 per cent of normal service voltage the corona measured was approximately 800 μ V. The other transformer was oil filled under a vacuum of 5 mm and showed a corona of only 56 μ V. For the second condition the transformer filled under the 5 mm

vacuum was subjected to $6\frac{1}{2}$ p.s.i. of nitrogen gas pressure at the oil surface for seven days, during which time oil circulation by pump was maintained. During this time the gas content of the oil was measured at intervals, until a saturation of 10.5 per cent was reached. Corona measurements were then repeated and these showed a reduced value, $25\text{ }\mu\text{V}$ at 115 per cent of service voltage.

The nitrogen pressure was then dropped in steps down to zero. Gas bubbles, passing the window in the pipe from the pump, could be seen in small numbers when the pressure had fallen to 5 p.s.i., and as the pressure became lower the number and size of bubbles increased. One hour after this pressure release, the transformer was again energised and corona measurement made, showing $28\text{ }\mu\text{V}$ at 115 per cent service voltage. Excitation of the transformer was maintained and after a period of 40 minutes the corona measurement suddenly increased to $800\text{ }\mu\text{V}$. The 60 c/s supply voltage was then reduced until corona ceased and then again increased to 115 per cent of the normal and again the corona measurement rose to $800\text{ }\mu\text{V}$.

Field corona tests have been made on a number of these same gas pressure system transformers at convenient intervals during service life. After approximately one year corona values of between 400 and $1,200\text{ }\mu\text{V}$ were measured. Comparable corona tests have also been made on transformers having winding and insulation construction similar to that used in the transformers referred to above, but employing a conservator system providing constant atmospheric pressure at the oil surface. Three

transformers were tested, one of 60 MVA, shown in Figs. 8 and 9, and two of 35 MVA, all operating at 132 kV. The 60 MVA unit has had six years' and the two 35 MVA eight years' service on the British grid system. Two methods of measurement were used, one complying with the N.E.M.A. publication 107, the other as described in the (British) E.R.A. report V/T 115, dated 1952. No corona was detected on these transformers at voltages up to 115 per cent of normal service voltages.

For any system of oil preservation the most important function is the maintenance of its high insulation property. That this may be jeopardised by a system involving regular variations of gas-oil surface pressure, as in the gas pressure system, is apparent. Gas bubbles may be released from a supersaturated oil under the direct influence of dielectric stress in the inner regions of an insulation structure, where small pockets of gas may be formed. They can lead to corona discharges which, by electro-chemical interaction in the presence of nitrogen, oil and copper, can cause deposition of semiconducting copper sulphide particles on the insulation surfaces in the vicinity. From the field service experience and laboratory investigations enumerated, it would appear that the chemical processes described are slow in action and may take several years to develop to a dangerous degree of deposition.

There has not yet been published evidence of failure of a transformer directly attributable to these causes, though it has been stated³ that certain troubles—the causes of which have not been determined for lack of

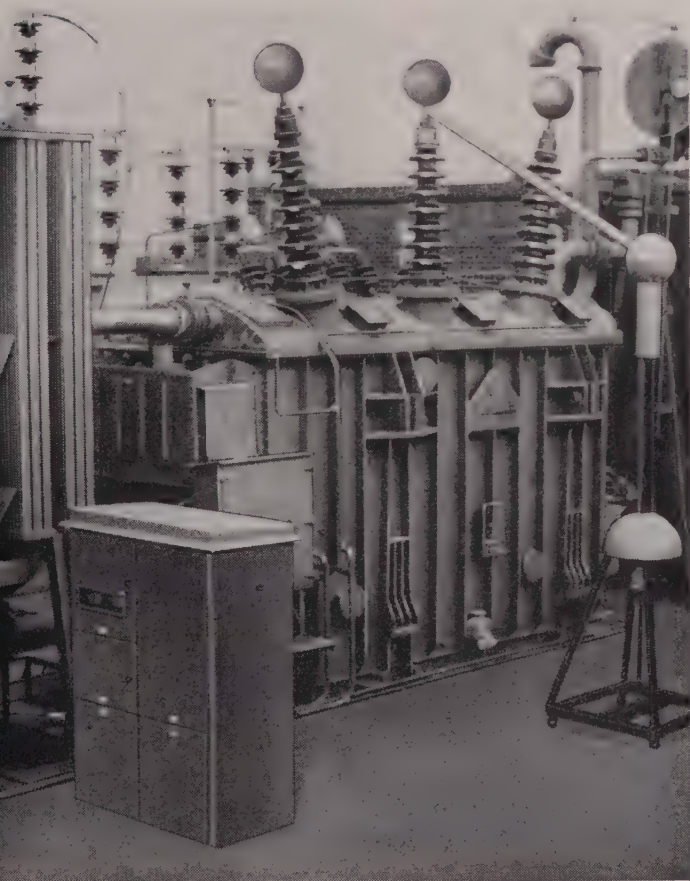


Fig. 8.—Field tests for corona being carried out on a 60 MVA, 132 kV transformer

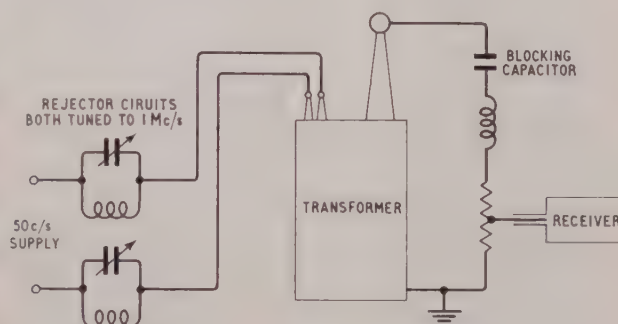


Fig. 9.—Schematic arrangement of the corona test circuit

evidence—may have had their origin as a result of bubble formation in a gas pressure system. As this phenomenon of gas bubble evolution is the direct and natural result of the employment of varying gas pressure at the oil surface, the continued use of such constructions should be reviewed.

It would appear that the oil conservator system or an alternative design, involving no appreciable oil surface pressure variation, should eventually become the generally accepted system of oil preservation for large high-voltage transformers.

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High-Voltage Laboratory

A new laboratory for the development and type testing of high-voltage cable and cable accessories has been established by Pirelli-General Cable Works, Ltd., at Eastleigh, Hants. At the same time a 400 kV oil-filled power cable and associated accessories have been designed and submitted for type approval

THE need for transmitting increasing quantities of electrical power has resulted in a steady increase in the operating voltage of transmission lines throughout the world. This upward trend has so far reached higher values of voltage abroad than it has in this country, but the recent proposal by the Central Electricity Generating Board to up-rate existing 275 kV lines to 400 kV will bring Great Britain into the forefront of progress in this field. In anticipation of the need for cables at this voltage

level, Pirelli-General Cable Works, Ltd., has designed and submitted for type approval a complete cable system for operation at 400 kV.

The cable is a low-pressure oil-filled cable, designed on the same basis as that for lower voltages, which has proved its reliability in service over many years, both in this country and abroad.

A complete range of accessories is available for use with the 400 kV cable and these consist of an outdoor sealing end; oil-immersed sealing end whereby the cable can be terminated in the entry chamber of a transformer; a straight-through joint; and a stop joint.

The cable is of the single-conductor type with an overall diameter of 4.1 in and a conductor cross-section of 0.9 sq in. The maximum stress at working voltage is 160 kV/cm, while the insulation thickness is 0.9 in. The impulse voltage withstand level is 1,400 kV, and during our visit to the company's new

over the range of soil thermal resistivity normally encountered. This is equivalent to the output of a large modern generating station.

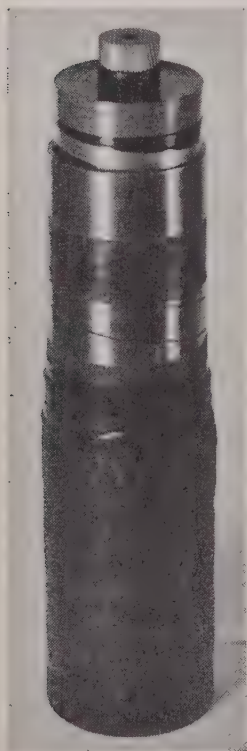
Type Testing

The new high-voltage laboratory has been established to deal with the type testing of new designs of high-voltage cable and cable accessories. This work has become increasingly important in recent years as improved materials and manufacturing methods have enabled cables to be designed for higher stresses and higher operating voltages than ever before. To maintain the rate of technical progress, necessary in the highly competitive conditions existing in the cable industry today, the company has recognised the need for improved facilities for development work by building this laboratory. The new laboratory utilises the test equipment already available with some additions, but affords greatly increased space and improved working conditions.

For work of the kind envisaged, floor space is one of the most important requirements. For example, an experiment on a new design of 132 kV, three-core straight joint, requires the erection not only of the joint itself but also of six sealing ends and two splitter boxes requiring an area of at least 1,500 sq ft. If the test in question is a type test on a new design of cable, it is usually necessary to include in the test assembly each type of accessory intended for use with the new cable and the floor space required becomes even greater. Moreover, such tests may continue for weeks or months and in some cases as much as a year, before approval of the new design is given. If work is to continue on a number of projects simultaneously, the importance of adequate floor space becomes evident.

A second important requirement is adequate height. In order to test cable systems for the highest voltages in use today, impulse voltages of 1.6-1.7 MV are required. Even higher voltages may be needed in the future. The impulse generator itself is 26ft high and the roof of the building must be of such a height that adequate clearance is available.

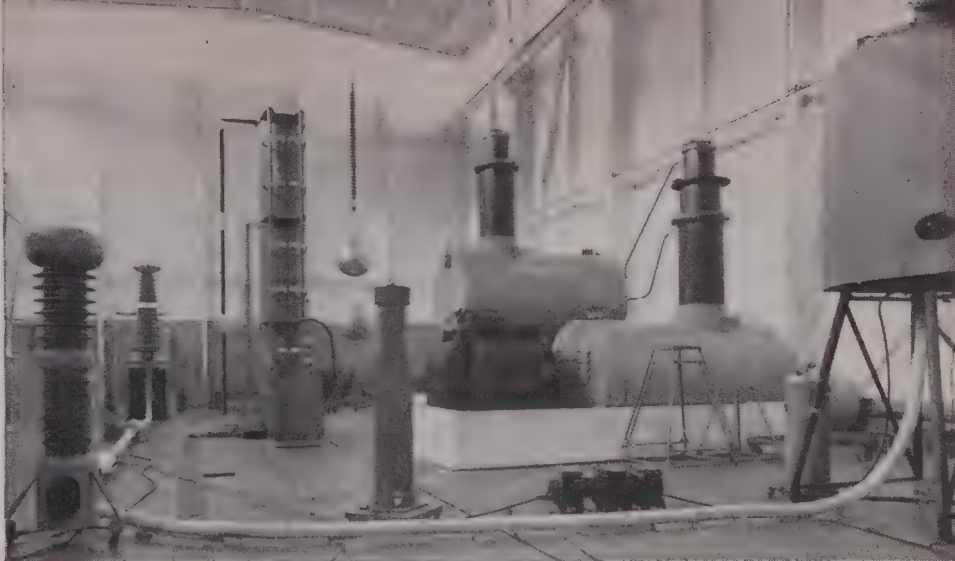
The new laboratory building meets these requirements with a floor area of 13,500 sq ft, and the height to the apex of the roof of the main test bay is 60ft; this not only allows adequate clearance at present, but provides for the addition of a further stage to the impulse generator. The building is divided into two bays, the larger of which is 125ft long by 70ft wide. This bay is used for the highest voltage testing and is of portal frame construction thus eliminating roof trusses. The height to the apex of the roof is 60ft and the height to the eaves 57ft. The smaller bay is 70ft by 65ft and has a pitched roof with a height



400 kV single-core paper-insulated lead-sheathed oil-filled cable

high-voltage laboratory last week we saw a cable assembly withstand 10 negative and 10 positive impulses at this voltage. The cable system under test included the complete range of accessories available for use with the cable and after the 1,400 kV test the voltage was raised in 50 kV steps to 1,600 kV with 10 negative and 10 positive impulses at each stage. The series of tests was successfully concluded at 1,600 kV without breakdown of the assembly. The cable is thus able to provide a three-phase circuit comprising three cables laid side by side in the ground with a spacing of 12 in centres to have continuous power transmission capacity of 528 to 675 MVA

General view of the main bay of the laboratory showing an assembly of 400 kV cable and accessories undergoing tests



of 32ft to the eaves. Both bays are steel framed, with aluminium sheeting and an insulating lining. The floor is of red quarry tiles to avoid the dust inevitable with a concrete floor.

Lifting facilities in the larger bay are provided by a 2-ton crane with a maximum height from hook to ground level of 48ft, and capable of passing over the highest test equipment in the laboratory. Lifting in the smaller bay is by means of a 1-ton crane with a maximum height of 27ft to the hook.

All the major items of test equipment are controlled from a central control room situated between the two bays at a height of 8ft above the laboratory floor. The control room is fitted with plate glass windows extending practically to floor level and sloping outwards from the floor, so that an almost uninterrupted view of the whole of the laboratory can be obtained.

The building is lighted by windows placed high in the wall around three sides of the main bay and by north-facing roof windows in the smaller bay. Artificial lighting is provided by eight 400 W mercury vapour lamps placed on the walls of the main bay just below the window level, and by eight smaller lamps suspended from the roof of the smaller bay. The decision to place the lamps on the wall of the high test bay was taken to simplify replacement of lamps which would become a major problem for equip-

ment on the roof 60ft from floor level. Both bays are heated by a unit type, oil-fired warm air heater with a capacity of $1\frac{1}{2}$ million B.Th.U./hr.

Impulse Generator

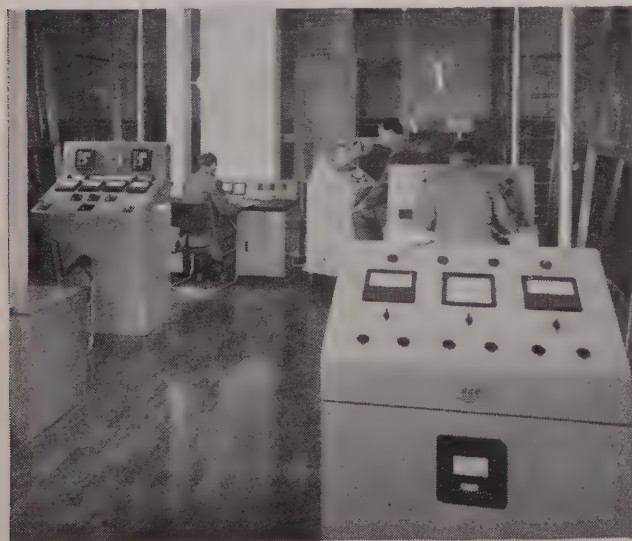
The most important items of test equipment for cable testing and development work are the impulse generator and high-voltage alternating current testing transformer; each bay of the laboratory is equipped with both of these items. The larger bay contains a Micafil impulse generator with an open circuit surge voltage of 2.4 MV and a surge energy of 57 kW-sec. This generator is of unusual design in that all the capacitors are contained in a central column of bakelised paper and it is of comparatively small size in relation to its output. The well-known Marx circuit is employed having 12 stages charged to a maximum d.c. voltage of 200 kV by a mechanical rectifier. The generator is on rails and is movable to four alternative operating positions, thus allowing the maximum flexibility in the layout of test assemblies.

The impulse voltage wave is monitored by means of a resistance capacitance voltage divider and transient recorder, with facilities for visual examination and photographic recording of wave shape.

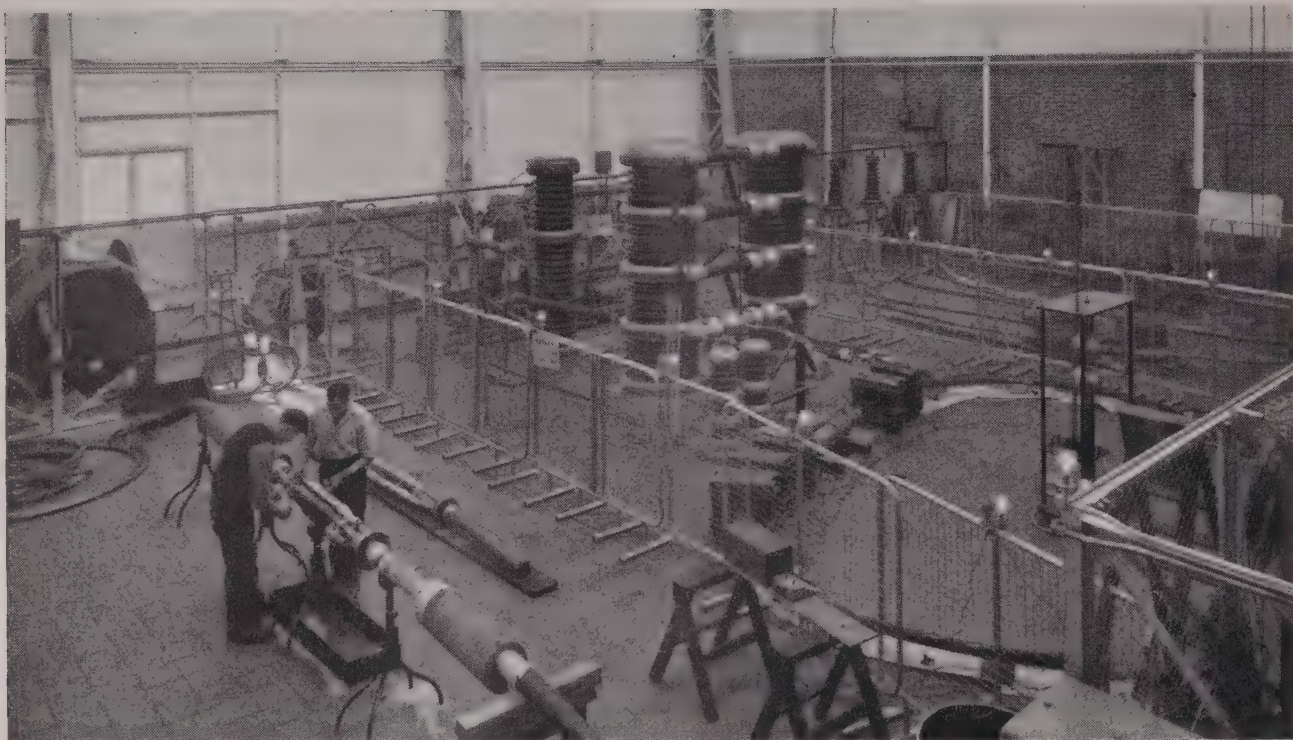
High-voltage a.c. testing in the large test bay is carried out by the use of two 500 kVA, 333 kV Ferranti transformers. One of these is insulated from earth for 333 kV and by means of a cascade connection the maximum output voltage can therefore be 666 kV. These transformers are also used for power factor tests by the Schering bridge method using a standard compressed gas condenser of the type of 100 pF capacitance and suitable for use up to 500 kV. Voltage measurement in this bay is by means of a 1.5 metre diameter sphere gap. The upper sphere is suspended from the roof and can be lowered by means of a winch on one wall at floor level to permit the crane to pass when necessary. Two alternative positions are provided for the sphere gap.

In the smaller bay of the laboratory there is a further 800 kV Ferranti impulse generator, consisting of four 200 kV stages and with a total surge energy of 22.4 kW-sec. High-voltage a.c. testing is catered for by one 300 kVA, 150 kV Ferranti transformer and a further 100 kVA, 30 kV transformer. A 50 cm sphere gap is used for voltage measurement in this part of the laboratory and a 100 kV, 100 pF standard condenser is available for power factor testing.

It is frequently necessary to heat the conductor of cable



Interior of the control room



Smaller bay of the laboratory viewed from the control room

assemblies undergoing test, and this is done by providing a link between the terminations of the cable so that the cable conductor forms part of a closed loop. The complete cable passes through the yoke of suitable step-down transformers and a current is induced in the cable conductor by this means. A total of 275 kVA, controlled by two induction regulators and available at five separate points in the laboratory, is used for the supply to these heating transformers.

Thermal resistivity is an important characteristic of cable insulation and is measured by passing a constant d.c. current through the cable conductor and making careful measurement of temperature drop through the

insulation. • The d.c. supply required for this test is provided by a motor-generator with a capacity of 30 kW and a maximum d.c. output of 3,000 A.

To ensure safety of personnel, an elaborate system of interlocking is provided between the control systems of the test equipment and the gates and fences of the test areas. Portable fences are used to surround the test assemblies to ensure maximum flexibility in the layout of the tests and these fences are coupled by plug-and-socket connections to one another and to points on the wall of the laboratory, with the result that the breaking of any of these plug-in links will automatically remove the test voltage.

I.A.E.A. GUIDE TO REACTORS

THE third volume of the "World Directory of Nuclear Reactors" has been published by the International Atomic Energy Agency (I.A.E.A.). It is a supplement to Volume II of the directory, published in December, 1959, and contains detailed information on 96 research, test and experimental reactors currently in operation or under construction in 21 countries. The reactors have been grouped into the following main categories: light water moderated, pool type (27 reactors); light water moderated, tank type (21 reactors); liquid homogeneous (six reactors); solid homogeneous (19 reactors); heavy water moderated (13 reactors); graphite moderated (four reactors); and fast research reactors (six reactors). Besides some general information, the detailed descriptions include physics data and data on the core and the fuel elements, core heat transfer, control, reactor vessel and overall dimensions, reflector and shielding, containment, cost estimate and

research facilities. Drawings and diagrams of the fuel element, core arrangement and of horizontal and vertical sections of the reactor are provided to convey a general idea of the layout and disposition of the reactor components and associated equipment.

The reactors described are in the United States (39), U.S.S.R. (18), United Kingdom (six), France and Switzerland (four each), Germany, India, Italy and the Netherlands (three each), Canada (two), and Brazil, Denmark, Pakistan, Philippines, Roumania, Czechoslovakia, Poland, Hungary, Japan, Sweden and the United Arab Republic (one each).

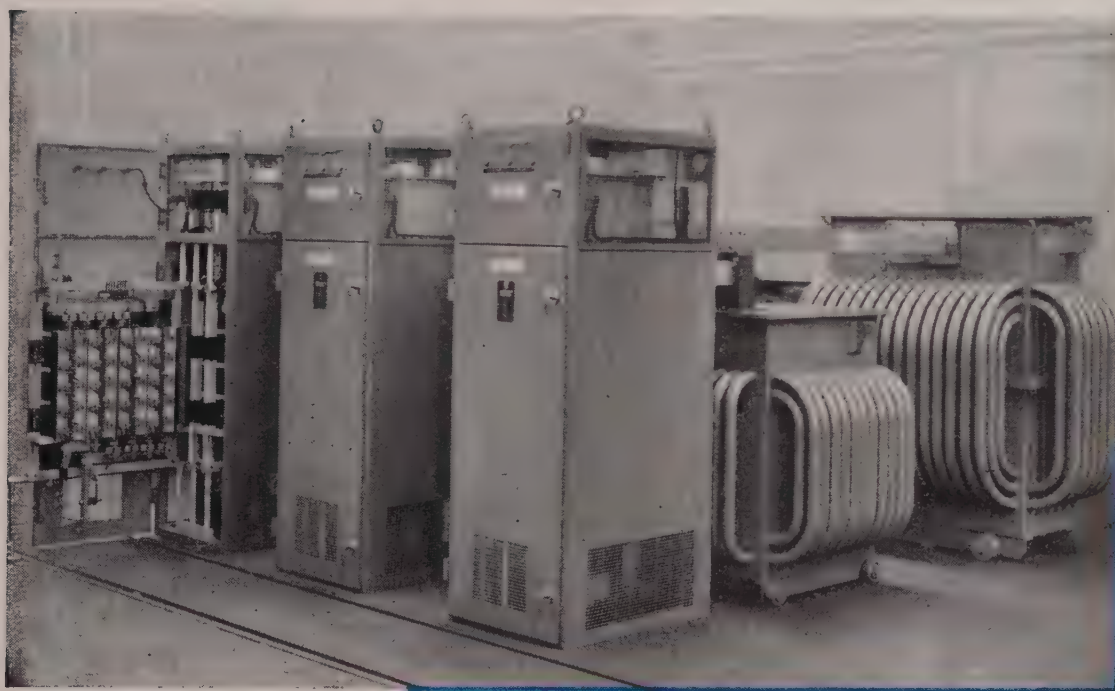
Volumes II and III of the directory describe 173 research, test and experimental reactors and Volume I, published in June, 1959, gives details of 36 power reactors. The Directory is available from I.A.E.A. sales agents or from I.A.E.A., Kärntnerring, Vienna I, Austria, price 24s.



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Proportion who do not own	Refrigerator	63%
	Radiogram	66%
	Washing Machine	67%
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	Tape-recorder	93%

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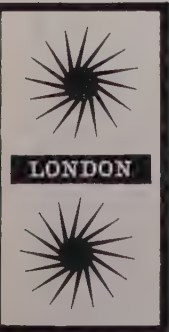
If you want further information,
John Talbot at Associated-Rediffusion (HOLborn 7888)
will be pleased to provide full details.

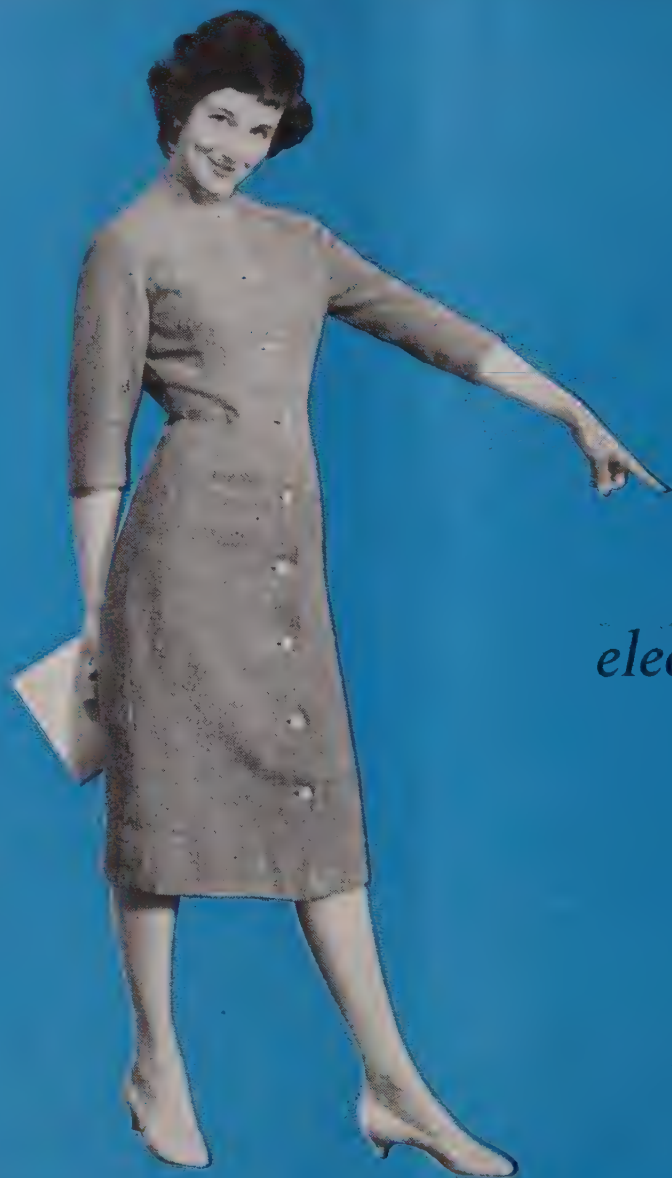


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PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Power has appointed **Alderman J. W. Sterland**, M.B.E., J.P., of Sheffield, as a part-time member of the Yorkshire Electricity Board as from 1st April.

Mr. Harry Richards, chairman of Wolf Electric Tools, Ltd., has retired



Mr. H. Richards

after 53 years' service. Mr. Richards joined the company as service manager in 1907 and held various executive positions before being appointed to the board in 1926. He became works director of the first Wolf factory in 1932, managing director in 1933 and chairman in 1951. He is remaining on the board of Wolf Electric Tools (Holdings), Ltd.

The South of Scotland Electricity Board has appointed **Mr. F. Anslow**, Associate I.E.E., deputy area engineer, Ayrshire Area, since 1950, as the area engineer. **Mr. W. H. Howard**, M.I.E.E., deputy area engineer, Glasgow Area, becomes engineer of the Stirling Area in succession to **Mr. H. A. Carson**, who is retiring.

Sir Willis Jackson, F.R.S., attended his first social function as president of the Association of Supervising Electrical Engineers recently when he and Lady Jackson were present at the

dinner and dance of the Central London Branch of the Association. The accompanying photograph was taken on this occasion.

Mr. D. E. Fox, B.Sc., M.I.Min.E., A.M.I.Mech.E., A.M.I.E.E., has been appointed H.M. Principal Electrical Inspector of Mines and Quarries in succession to **Mr. J. Cowan**, C.B.E., M.I.Min.E., M.I.E.E., who retired on 1st February. Mr. Fox graduated in electrical engineering at the University College of Swansea and after completing a two-year post-graduate course with the General Electric Co., Ltd., he held various technical appointments with the Ministry of Supply until 1946. He then spent a year with Powell Duffryn before joining the National Coal Board as group electrical engineer in 1947. Mr. Fox entered the Mines Inspectorate in 1949 as an electrical inspector of mines and quarries and served in the South Western Division until 1957, when he was appointed deputy principal electrical inspector and transferred to headquarters. He is a past-president of the South Wales Branch of the Association of Mining Electrical and Mechanical Engineers.

Following the recent retirement of **Mr. R. C. Burton**, after 50 years' service in the electricity supply industry, the Merseyside and North Wales Electricity Board has appointed **Mr. J. T. Lornie**, A.M.I.E.E., as senior assistant engineer (technical development) at Board headquarters. Mr. Lornie was formerly senior assistant

commercial engineer (industrial supplies), and he has been succeeded in this post by **Mr. W. C. Dobie**, A.M.I.E.E., previously second assistant engineer (planning). **Mr. G. G. Barnes**, A.C.A., assistant accountant in the Board's No. 2 Sub-Area, has been appointed accountant for No. 3 Sub-Area (Chester). He will succeed **Mr. R. Bennett**, O.B.E., who is retiring in the near future.

The General Electric Co., Ltd., announces the appointment of **Mr. F. J. B. Barry** as commercial manager of the Witton (Birmingham) Engineering Works.



Mr. F. J. B. Barry

Mr. Barry was educated at Felstead School and started with the Metropolitan-Vickers Electrical Co., Ltd., as a school apprentice in 1923, subsequently joining the company's sales staff. In 1942 he was seconded to the Ministry of Supply and was appointed Deputy Director of Weapon Production. He returned to Trafford Park in 1945 as assistant sales manager of the Plant Department, being promoted to sales manager in 1949. In 1955 he joined the G.E.C. as manager of the Plant Liaison Department in London.

Mr. P. F. J. Trollope, A.M.I.Mech.E., M.I.Mar.E., has been appointed to the board of Hawker Siddeley Brush Turbines, Ltd., with the title of works director. After 26 years in the Royal Navy, Mr. Trollope retired in 1957 with the rank of commander and was appointed works manager of the Turbine Division of the Brush Electrical Engineering Co., Ltd., subsequently becoming personal assistant to the managing director on special projects. He left the company in 1960 to join the Administrative Staff College, where he spent three months on the directing staff before joining Hawker Siddeley Brush Turbines.

More than 100 members and guests attended the January luncheon meeting of the **Batti-Wallahs' Society** at the Connaught Rooms, London, last week. **Mr. J. S. A. Bunting**, president,



Left to right: Mr. E. A. Bromfield (general secretary, A.S.E.E.), Mrs. Bromfield, Sir Willis Jackson, Mr. W. L. T. Nicholson (chairman, Central London Branch, A.S.E.E.) and Mrs. Nicholson

was in the chair and the guest speaker was Mr. G. E. Walker, director and secretary, Associated Electrical Industries, Ltd. Mr. Walker, despite his connections with the Bar (he is a barrister-at-law and a former judge advocate of the Royal Indian Navy), is a firm believer in the need for economy in words in everyday business life and his talk, in which he advocated a greater use of basic English, proved to be educational as well as highly amusing. A vote of thanks to the speaker was given by Mr. J. W. Perkins, a past-president. The next meeting will be on 22nd February, when the speaker will be Captain Lister, of the Port of London Authority.

Mr. S. A. Clodd, M.I.Prod.E., has been appointed to the board of E. K. Cole, Ltd. He joined Ekco during the war as material controller, was appointed works manager in 1950 and became an executive director in 1957.



Mr. S. A. Clodd

Mr. Charles F. Dickinson, O.B.E., has been appointed a vice-chairman of Crompton Parkinson, Ltd.

Mr. R. G. Hooker, J.P., whose appointment as deputy managing director of K & L Steelfounders & Engineers, Ltd., a member of the George Cohen 600 Group, is announced, studied electrical engineering at the Borough Polytechnic and served his apprenticeship with Philips Electrical, Ltd., subsequently becoming personal assistant to the chief electrical engineer. In 1951 Mr. Hooker joined the Brush Group and in the following year was appointed general works manager of J. & H. McLaren, Ltd., Leeds. He was appointed to the board of the Brush Electrical Engineering Co., Ltd., in 1954 as works director, and in 1957 was promoted to general manager.

The Eastern Electricity Board has appointed **Mr. D. Pickup**, A.M.I.E.E., at present first assistant district engineer in the Clacton District, to succeed Mr. S. M. Lejeune, the Board's engineer at Enfield for many years. As already reported, Mr. Lejeune is taking up an appointment in the Chilterns Sub-Area.

Mr. S. Tudor has been appointed production manager of Alfred Ellison, Ltd. He has represented the company

in the North of England for the past 11 years and previously spent 14 years on the drawing office and design staff of the associated company, George Ellison, Ltd. Mr. Tudor is succeeded in the North of England by **Mr. J. K. Gascoigne**.

The Uganda Electricity Board announces that the title of the position held by **Mr. J. M. Stock**, O.B.E., M.Eng., M.I.C.E., M.I.Mech.E., M.I.E.E., has been changed from chief electrical engineer to chief engineer and that held by **Mr. L. Fergusson**, M.I.E.E., from deputy chief electrical engineer to chief electrical engineer. There has been no change in the responsibilities of **Mr. S. W. Didsbury**, M.I.Mun.E., and **Mr. W. D. Ramway**, B.Sc., A.M.I.E.E., who continue as heads of the civil engineering and commercial engineering departments, respectively.

Mr. C. B. Reynolds, sales manager (Parnall Products) of the Electrical Division of Radiation, Ltd., has been elected an alderman of Walthamstow.

Mr. A. B. Tilleray has been appointed by Thorn Electrical Industries, Ltd., as sales manager of their Industrial Control Division, responsible for marketing electronic and electro-mechanical control equipment and systems developed and produced by Nash & Thompson, Ltd., and the Electronics Division of the Ferguson Radio Corporation, Ltd. He was formerly with the Sorensen Division of J. Langham Thompson, Ltd.

The 27th **E.D.A. Carnival** took place on 20th January at the Oxford Galleries, Newcastle-upon-Tyne. The 1,200 guests were received by Mr. C. St. L. Brightman, chairman, Tyne and Wear Area, Electrical Industries Benevolent Association, and Mrs. Brightman, assisted by Mr. J. Bennett, deputy chairman, and Mrs. Bennett. During the evening 150 prizes, which had been generously donated by all



Mr. J. Henderson, M.I.Mech.E., M.I.Prod.E., who, as we reported last week, has been appointed general works manager of C. A. Parsons & Co., Ltd.

sections of the electrical industry, were distributed for various events. The proceeds of the Carnival, exceeding £700, will be given to the E.I.B.A.

Mr. F. P. Laurens, O.B.E., M.I.Mech.E., assistant managing director (production) of International Computers & Tabulators, Ltd., is leaving London this week for a six-week visit to South Africa.

George Kent, Ltd., have appointed **Mr. Rodney Kent** to be deputy chairman and **Mr. W. May** assistant managing director. **Mr. J. G. Vaughan**, F.C.A., managing director of the Charterhouse Finance Corporation, has joined the board.

Mr. M. T. Rimmer, A.C.A., has been appointed secretary and accountant of Fawcett Preston & Co. and secretary of the New Eagle Foundry Co., both members of the Metal Industries Group.

Mr. Ken Wood, managing director of Kenwood Manufacturing (Woking), Ltd., and **Mr. A. C. Brooking**, secretary and financial director, left in the *Queen Mary* last Friday for a three-week tour of the United States and Canada.

Remploy, Ltd., the national organisation for employing the severely disabled, has appointed **Mr. F. C. Thomas** as manager of the sales division marketing tubular sheathed electric elements. Mr. Thomas, who has been with Remploy for ten years,



The reception party at the E.D.A. Newcastle Carnival (left to right): Mr. J. Bennett, Mrs. Bennett, Mrs. C. St. L. Brightman and Mr. C. St. L. Brightman

was formerly assistant to the manager, Mr. A. C. Goodall, who died shortly before Christmas.

Mr. A. Elliot, export manager for Baird & Tatlock (London), Ltd., has been appointed general sales manager of the associated company, W. B. Nicolson (Scientific Instruments), Ltd.

We are pleased to learn that **Mr. E. M. Lee**, director and general manager of Belling & Lee, Ltd., is now back home after six weeks in hospital.

Mr. Geoffrey Cole has been appointed advertising manager of the Lighting and Heating Group of the General Electric Co., Ltd. He joined the company on 1st February from Thorn Electrical Industries, Ltd., where he was advertising manager of Atlas Lighting, Ltd.



Mr. G. Cole

Mr. Cole has also worked with several advertising agencies including S. H. Benson and Alfred Pemberton. He is a member of the Publicity Committee of the Illuminating Engineering Society.

The following appointments have been made to the board of the Horstmann Gear Co., Ltd.:—**Mr. F. O. Horstmann**, formerly managing director and recently technical director, becomes chairman; **Mr. C. A. Mant**, chairman since 1946, becomes vice-chairman; **Mr. F. A. Wheeler** remains secretary with a seat on the board; and **Mr. D. W. Nicholds**, recently works manager, becomes works director.

Mr. W. Briggs, director and manager of the Contracts and Sales Department of Erskine, Heap & Co., Ltd., has retired following a period of ill-health. His service with the firm covered 51 years. **Mr. G. Webb**, who has been assistant manager for several years, becomes manager of this department.

Mr. C. E. Knight, formerly technical sales manager of the Fan Department of the Sturtevant Engineering Co., Ltd., has taken up an appointment in the Marketing Department of the National Coal Board at Hobart House, London.

Wing-Commander Antony Strutt, O.B.E., F.R.A.S., F.B.I.S., has been appointed to the newly-created post of general manager of the Electrical Products Department of James A.

Jobling & Co., Ltd., makers of "Pyrex" industrial and scientific glass. Wing-Commander Strutt has just retired from the R.A.F. where he was in command of a specialist unit handling electronic equipment.

Mr. J. Bishop, formerly of A. J. Mare (Birmingham), Ltd., has joined the Electronic & Mechanical Engineering Co., Ltd., where he will be responsible for technical sales of creep testing machines and the design and development of other electronic systems to customers' specifications.

Mr. A. W. Fisher, B.Sc., M.I.E.E., whose forthcoming retirement from the position of London manager and local director of Higgs Motors, Ltd., was reported in our last issue, tells us that he is now convalescing at home. His address is Martyns, Swallowfield, near Reading. In last week's biographical note we regret that Mr. Higgs' name was inadvertently printed in place of Mr. Fisher's.

Mr. Alan Threlfall, A.M.I.Mech.E., Grad.I.E.E., has been appointed sales manager of Perkins Gas Turbines, Ltd.

OBITUARY

Professor Francesco Giordani, who died in Naples on 24th January at the age of 64, was prominent in the field of nuclear power development. From 1952 to 1956 he was chairman of the Italian Council for Nuclear Research and he was head of the Italian delegation to the first Atoms for Peace Conference in Geneva in 1955. He was joint author of the report presented to the European Atomic Community on the role of nuclear power in satisfying the Western European demand for electricity. Up to last year Professor Giordani was chairman of the Italian National Council for Research.

Mr. Rowland Wright, M.B.E., M.I.E.E., A.M.I.Mech.E., who died recently at Atkinson Morley's Hospital, Wimbledon, at the age of 59, was for many years with the Madras Electricity Supply Corporation and when the company was nationalised in 1947 to form the Madras Government Electricity Department he was appointed generation superintendent for thermal power, a position he held until 1951. He then left to become deputy chief engineer to the Buckingham & Carnatic Co., Ltd., who own a group of cotton mills in the Madras area, and in 1954 he was appointed chief engineer, the position he held at the time of his death.

Mr. Wright was educated at Rutlish School, Merton, Rugby Technical College and the City and Guilds of

London Institute. He served his apprenticeship with the British Thomson-Houston Co., Ltd., and before going to Madras in 1928 he was for a short time with the Leicestershire & Warwickshire Power Co.

Mr. Hamish Kirkwood, a well-known member of the Radio Industries Club and of the Radio Industries Golfing Society, died suddenly on 19th January at Guildford. He was 54 and leaves a widow and three sons. Mr. Kirkwood was appointed secretary of the Association of Dry Battery Manufacturers in 1951 and six years later he became secretary of both the British Starter Battery Association and the Accumulator Manufacturers' Association.

Mr. Arthur L. Sharpe, who for 36 years had represented Berry's Electric, Ltd., in the north-east of England, died on 19th January. He was 58. Mr. Sharpe joined Berry's from the Kensington & Knightsbridge Electric Supply Co. in 1925 and opened one of the company's first branches, at Newcastle, where he remained as manager until re-grouping brought his area into a larger territory with headquarters in Manchester. In spite of ill-health, Mr. Sharpe continued to look after the north-eastern area until his death.

Mr. F. H. Brandreth.—The death occurred recently in hospital at the age of 80 of Mr. Frederick Herbert Brandreth, who retired in 1945 after 36 years' service with Edmundsons Electricity Corporation, for some time as manager of the Urban Electric Supply Co. at Grantham.

Mr. A. McDougall.—The death occurred at Hove on 27th January, after a long illness, of Mr. Alfred McDougall, M.B.E., M.I.E.E., formerly of Abadan.

Mr. R. W. Freemont.—The death is reported of Mr. R. W. Freemont, a director of the Phoenix Electrical Co. (London), Ltd.

Mr. D. W. Barnacle.—The death has occurred of Mr. D. W. Barnacle, sales promotion manager of Alfred Imhof, Ltd.

WILLS

Sir Arthur Fleming, K.B.E., former director of research and education to Associated Electrical Industries, Ltd., and a past-president of the Institution of Electrical Engineers, who died on 14th September last, left £202,948 gross (£199,902 net).

Mr. Eustace Thomas, M.I.E.E., director of Bertram Thomas (Engineers), Ltd., who died on 11th October last, left £73,057 gross (£72,758 net).

Mr. V. H. Purdy, managing director and a founder director of E.M.F. (Electrical), Ltd., who died on 6th September, left £13,254 gross (£13,173 net).

NEW G.E.C. APPOINTMENTS

THE General Electric Co., Ltd., announces that **Mr. T. B. O. Kerr** has been appointed deputy managing director and that **Mr. E. H. Davison** is to be financial director of the company. Mr. Davison is at present treasurer of Courtaulds, Ltd., who have agreed to release him so that he can take up his new duties on 1st March.

To strengthen the management, other appointments are being planned which will be announced in due course. A Management Committee has been formed, the members of which are Mr. Arnold Lindley (chairman of the company), Mr. T. B. O. Kerr, Mr. E. H. Davison, Mr. O. W. Humphreys and Mr. R. N. Millar.

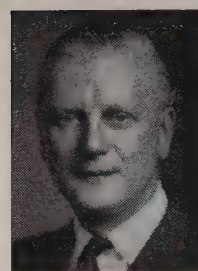
Mr. Kerr was educated at Uppingham and Wadham College, Oxford. He joined the G.E.C. in 1930 as a commercial trainee and subsequently moved to the company's Sales Department in London. After occupying various positions, he was appointed personal assistant to Dr. H. Railing—later Sir Harry Railing, a former chairman of the G.E.C.—in 1934. Mr. Kerr occupied that post for some 13 years and also worked at one period as an assistant to Lord Hirst. In 1947 he was appointed assistant secretary to the company and, two years later, became secretary. He joined the G.E.C. board in 1952 and was made director for finance and administration in 1959.

Mr. Davison was educated at Dulwich College and after qualifying as a chartered accountant he held appointments with E.M.I., Turner Brothers Asbestos Co., Ltd., and S. Simpson, Ltd., before joining Courtaulds, Ltd., in 1946. He became chief accountant in 1947 and treasurer in 1957. Mr. Davison was a member of the Verdon-Smith Committee set up by the President of the Board of Trade in 1953 to consider the Censuses of Production and Distribution.

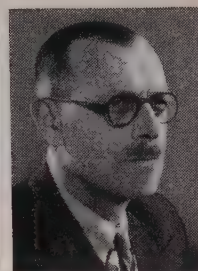
Mr. O. W. Humphreys, C.B.E., B.Sc., F.Inst.P., M.I.E.E., F.R.Ae.S., director of the Hirst Research Centre, joined the staff of the G.E.C. Research Laboratories in 1925 after graduating in physics at University College, London. He succeeded the late Sir Clifford Paterson as director of the Research Laboratories in 1949 and joined the board of the company in 1953. His responsibilities were further broadened in 1959 when he was appointed director for research and technical development. The direction of the work of the Centre is now

largely entrusted to three deputy directors. His outside interests in research include the chairmanships of the Electrical Research Association and of the D.S.I.R. Radio Research Board. He is also chairman of the Guided Weapons Committee of the Society of British Aircraft Constructors, the International Special Committee on Radio Interference and two of the Postmaster General's Advisory Committees on Radio Interference. He was president of the Institute of Physics from 1956 to 1958 and is now a vice-president of the Institution of Electrical Engineers.

Mr. R. N. Millar, M.A.(Cantab.), B.Com., M.I.Mech.E., A.M.I.E.E., was educated at Marlborough College and, following an engineering apprenticeship at the Erith Works of the G.E.C., took the Mechanical Science Tripos at Emmanuel College, Cambridge University. During the war he served as an engineer officer in the Royal Navy, and in 1947 was appointed assistant mechanical engineer to the British General Electric Co. in South Africa.



Mr. T. B. O. Kerr



Mr. E. H. Davison

While there he took another degree in economics and industrial administration. In 1952 he was transferred to Sydney, Australia, as chief mechanical engineer of the British General Electric Co. Pty., Ltd. Towards the end of 1954 Mr. Millar was recalled to England to take charge of nuclear energy developments in the G.E.C., and later that year became manager of the G.E.C. - Simon-Carves Atomic Energy Group. Early in 1957 he was appointed assistant general manager of the Erith Works of the G.E.C., becoming general manager a year later. In 1959 he became a director of the company and was appointed managing director of the Engineering Group in 1960.

Industrial Instrument Manufacturers

THE ever-growing importance of the British industrial instrument industry was stressed by the large attendance at the annual luncheon of the British Industrial Measuring and Control Apparatus Manufacturers' Association held on 17th January at the Hyde Park Hotel, London. The guest of honour was Lord Mills, P.C., K.B.E., the Paymaster General.

Proposing the toast of the Association, Lord Mills pointed out that the instrument industry, with its knowledge of electronic, pneumatic, hydraulic and electrical systems of control, was in a unique position. It had "a finger in every pie," and was thus a potent factor in the development of the manufacturing industries on which our future depended.

In his reply, Mr. W. T. Marchment, chairman of the Association, referred to some of the developments taking place within the industrial instrument industry. He welcomed the growing practice of instrument companies joining together and forming consortiums to deal with the very large jobs which were to be obtained abroad, and also the increasing number of exhibitions and conferences, which were all to the good in keeping industry alive to the

growing value of instrumentation. He forecast that the next major step in automation would be the development of decision-making apparatus to add to the already accepted functions of measurement and control. He was sure that this could be a British achievement when he considered the enormous fund of traditional British ingenuity and inventiveness represented by the member firms of BIMCAM.

The toast of the guests was proposed by the Association's president, Mr. W. G. Thomas. Responding, Mr. G. C. Eltenton, president of the Society of Instrument Technology, urged the need for a wider recognition of instrument technology as a major science, pointing out that the rapid advances in instrument technology could be endangered unless the call for trained men could be met.

EXPORT ISSUE CORRECTION

The caption to the photograph at the top of page 162 should read "Taking speed-curve of side moving contacts of a Reyrolle 132 kV air-blast circuit-breaker."

INDUSTRIAL NEWS

Nuclear Power Collaboration

LAST June it was announced that the G.E.C./Simon-Carves Atomic Energy Co., Ltd., and Atomic Power Constructions, Ltd. (representing Crompton Parkinson, Ltd., International Combustion (Holdings), Ltd., Richardsons, Westgarth & Co., Ltd., and the Fairey Aviation Co., Ltd.), had agreed to collaborate in the field of nuclear power development. A new company—the United Power Co., Ltd.—was subsequently formed but action was suspended on account of the discussions (later discontinued) between the General Electric Co., Ltd., and the English Electric Co. upon a possible merger of these companies.

Now it has been decided that the United Power Co. shall proceed; its headquarters are at 28, Theobald's Road, London, W.C.1. The company represents an equal partnership between the G.E.C./Simon-Carves group and Atomic Power Constructions, Ltd. (now consisting of International Combustion (Holdings), Ltd., Richardsons, Westgarth & Co., Ltd., and the Fairey Engineering Co.). Crompton Parkinson, Ltd., inform us that they are withdrawing from Atomic Power Constructions to facilitate the merging of the two groups.

The chairman of the United Power Co., Ltd., is Mr. A. L. G. Lindley (chairman of the G.E.C.); the deputy chairman is Lord Coleraine (chairman

of Atomic Power Constructions); the managing director is Col. G. W. Raby (managing director, Atomic Power Constructions); the directors are Mr. H. Clarke (joint managing director, Simon-Carves, Ltd.), Mr. J. Mayer (joint managing director, International Combustion (Holdings), Ltd., and chairman, International Combustion, Ltd.), Mr. R. N. Millar (managing director, Engineering Group, G.E.C.), Mr. O. J. Philipson (chairman, Richardsons, Westgarth & Co.), Mr. C. C. Vinson (director, Fairey Engg. Co.) and Dr. K. J. Wootton (general manager, Erith Engineering Works, G.E.C.); the joint technical directors are Dr. H. K. Cameron (manager, Atomic Energy Division, G.E.C.) and Mr. J. W. Ashley (technical director, Atomic Power Constructions).

The United Power Co. is tendering for the projected nuclear power station at Oldbury.

Slurry-Burning Power Station

A new £5 million slurry-burning power station is to be built in Fife by the South of Scotland Electricity Board. Mr. William Hutton, deputy chairman of the Board, who announced this on 19th January, said that it would be similar to the Barony station in Ayrshire, the economic success of which had encouraged the Board to go ahead with a similar venture. A list of possible sites had now been narrowed down to four, but a final decision, Mr. Hutton said, was unlikely to be taken for several months.

The new station is expected to be commissioned in 1965. Like Barony, it will have an installed capacity of 60 MW (two 30 MW sets) and will burn about 250,000 tons of slurry each year.

CABLES FOR BRAEHEAD

The South of Scotland Electricity Board has placed a £70,000 contract with the A.E.I. Construction (Cables and Lines) Division for cabling for a 60 MW extension at Braehead power station.

New Storage Battery Factory in Australia

THE first section of a new industrial battery production plant at Padstow, New South Wales, was recently opened by the N.S.W. Minister of Labour and Industry, the Hon. J. J. Maloney, the ceremony being attended by over a hundred guests. When completed towards the end of 1962 the factory will occupy an area of 19 acres and will become the administrative and production centre of the Associated Battery Makers of Australia (Pty.), Ltd., a subsidiary of the Chloride Electrical Storage Co., Ltd.

Founded in 1930, the Australian company began manufacturing car, radio and home-lighting batteries under the brand names of "Exide" and "Tudor" and a local brand

"Masse." In 1935 production of train lighting cells, Planté stationary cells and Kathanode traction batteries was started. Later, the need arose for the manufacture of aircraft batteries and other special types required by the armed forces. In 1957 production started on the clear plastic container type cells used for telephone equipment and this was closely followed by the manufacture of the slotted ebonite tubular positive plate ironclad traction battery. The latest development in the traction field is the recently introduced woven "Terylene" tubular positive plate "gauntlet" cell which gives up to 35 per cent greater capacity than a conventional type cell of the same size.

CYPRUS SEEKS A LOAN

The Nicosia correspondent of *The Times* reports that the Government of Cyprus intends to approach this country for a loan to enable an £11 million electrification expansion scheme to be started. Initially £2-£3 million will be required towards the first part of the scheme, the extension of the 72 MW Dhekelia power station. Later it is proposed to provide a new station and extend the grid system throughout the island.

Ash Handling Plant for Australia

An order worth £A.579,562 has been received by John Thompson Industrial Constructions, Ltd., from the New South Wales Electricity Commission for hydraulic ash and fly ash collection and disposal plant at Vales Point power station. Half of the equipment will be manufactured in England and the rest in Australia.

The Hon. J. J. Maloney, Minister of Labour and Industry, arriving by helicopter to open the industrial battery production plant at Padstow, N.S.W., accompanied by Mr. L. D. Atkin, the company's general sales manager



INDUSTRIAL NEWS *[continued]*

Refrigerator Makers' Position

LEADING makers of refrigerators formed, in 1956, the Domestic Refrigeration Development Committee (DoRDeC) and that body now has twelve members. Last week the chairman of the Committee, Mr. E. G. Rowledge (Pressed Steel Co., Ltd.), gave the trade press some views on the past year and the industry's prospects. He said that 1960 had been a difficult period, partly on account of the bad summer, but also by reason of changes in hire-purchase policy. In 1958 h.p. restrictions had been removed and the result was a surge of orders for refrigerators in 1959 which had embarrassed the manufacturers who found it difficult to meet the demand. That had led to a considerable increase in imports. Restrictions had been reimposed in 1960 so that although production had risen by 11-12 per cent the volume of sales remained about the same.

Sudden changes in hire-purchase regulations made forward planning impossible. The Committee had had a meeting with Mr. F. J. Erroll, Minister of State, Board of Trade, who was asked to reduce the stipulated amount of down payment to 10 per cent and to discriminate between the refrigerator industry and others in which conditions were not comparable.

Mr. Erroll had expressed the Board's view that home sales should be regarded as secondary to export business, but the makers considered that to be impossible. Export trade could be based only on a firm home market; it was not feasible just to divert their products from the home to the overseas markets, especially if they were to sell in Common Market countries. Exports in 1960 had risen by 10 per cent, but not by diverting refrigerators from the home market.

Mr. Rowledge maintained that for technical quality, appearance, features and price British refrigerators could not be beaten. He gave particulars of some of the ways in which DoRDeC

was promoting the sale of refrigerators in this country and mentioned that the Ideal Home Exhibition preview of refrigerators was to be held at the Café Royal on 25th February.

In the general discussion which ensued it was stated that unsold stocks of refrigerators were not so high as had been suggested. There would be no fundamental changes in design during the next twelve months. It was considered that dealers should be more active in assessing the prospects and they should not hold up their orders until May when it would be physically impossible to make deliveries in time for the season. The opinion was expressed that dealers were not actively selling refrigerators. There was a need for the adoption of the American system by which dealers provided manufacturers with regular returns of stocks of refrigerators.

Anglo-American Electronic Equipment Agreement

LANCASHIRE Dynamo Electronic Products, Ltd., Rugeley, Staffs. (Metal Industries Group), has concluded a licence agreement with the Emerson Electric Manufacturing Co. of St. Louis, Missouri, under which the American company will have the right to manufacture in the United States on a royalty basis the complete range of industrial electronic control equipment which has been designed, manu-

factured and marketed by the British company over the past fifteen years. The agreement provides for a continuing flow of information to Emerson on new developments in equipment and manufacturing techniques on a reciprocal basis. Among products covered by the agreement are a complete range of specialised adjustable speed drives for all types of industrial process, regulator equipment, circular and strip chart recorder/controllers for the process industries, machine tool control systems, a wide variety of photoelectric equipment, resistance welding controls and many other specialised devices for automatic control in industry.

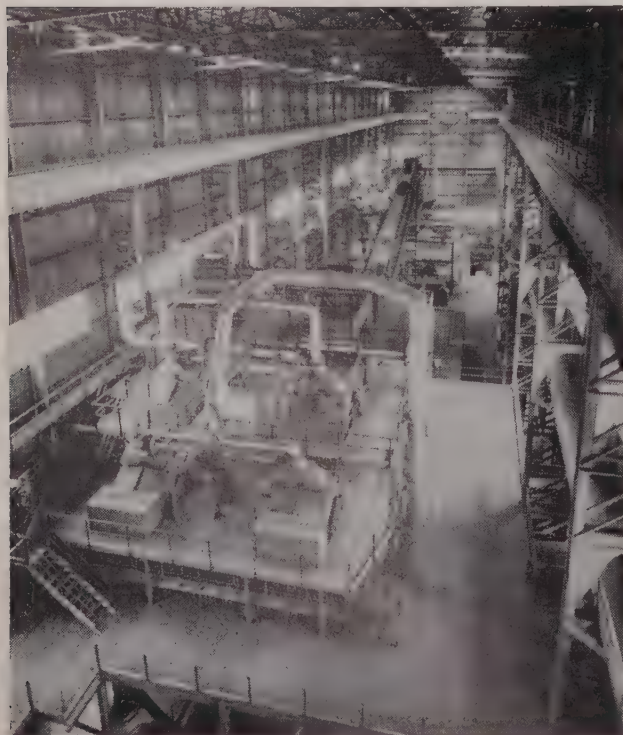
The Emerson Co. for many years has been a major producer of military electronic equipment and associated mechanical devices for the U.S. Government and it is also a leading supplier of small electric motors, air-conditioning systems, industrial and domestic lighting fittings and products for electrical installations in the home.

Arrangements will be made for the exchange of personnel between the two companies for training purposes. In the initial stages it is anticipated that specialised parts will be exported to the United States for incorporation in complete equipments.

Coal Prices in Ulster

The Northern Ireland Minister of Commerce (Lord Glentoran) has appointed a Committee, under the chairmanship of Mr. B. J. Fox, Q.C., to inquire into the level of coal prices in Northern Ireland.

Steelworks Sinter Plant



General view of the primary crushing screens in the new sinter plant at the Scunthorpe steelworks of John Lysaghts. All the electric motors on the ore preparation and strand mixing plant, ranging from 15 h.p. to 450 h.p., and two 2,750 h.p. motors for driving the sinter fans were supplied by the English Electric Co., Ltd.

London-Manchester Line to be Electrified

THE Minister of Transport (Mr. Marples) announced in the House of Commons on Monday, during a debate on the proposed reorganisation of the railways, that the Government had decided that electrification of the London-Midland main line to Crewe, Manchester and Liverpool should go ahead. Many people, he said, had been worried that the future of this work was in doubt. But, it would have been wrong to let the scheme proceed on the information before the Government last summer, especially remembering the grave financial plight of the railways and the amount of public money involved.

The pause for reconsideration had been fully justified, he said. The Commission had now made firmer estimates than ever before of the results of electrification, both new receipts and savings in costs. They had prepared a comprehensive scheme with proposals for phasing the investment which they were satisfied they could keep to. There was now a much clearer picture about its relation to the proposals for railway investment.

The scheme would go ahead as

quickly as was consistent with the best use of resources. "I must make it clear," he continued, "that I shall keep the scheme under close review . . . and that Government approval of this electrification work does not mean that other main line electrification will necessarily be approved. But the approval of this—the largest scheme

of all—should be taken as evidence of the Government's faith not only in modernisation but in the British electrical manufacturing industry."

The Parliamentary Secretary (Mr. Hay), concluding the debate, said the Ministry believed the scheme could be completed by 1966. The additional two years were required because the scheme for the first time included the reconstruction of Euston station and because regard must be had to the resources available.

POST OFFICE DEVELOPMENTS

IN moving the second reading of the Post Office Bill, which reorganises the finances of the Post Office, the Postmaster General (Mr. Bevens) said that last year 450,000 new telephones were installed, 13 per cent more than in the previous year. At the same time the demand was higher than ever before. He was determined to prevent the number of those waiting for telephones rising higher than the present figure of about 50,000.

There were now fewer than 900 local manual exchanges, which it was planned to convert to automatic operation by 1970. By next March there would be about 250,000 sub-

scribers connected to 69 exchanges on the subscriber trunk dialling system. During the coming year S.T.D. would be introduced at the rate of five exchanges a week and by March next year the number of new subscribers on this service would have increased to about 1,250,000.

There was also a major programme for the mechanisation of the inland telex service. At present there were about 6,000 customers who could connect with subscribers in about 40 other countries. An automatic service to Germany would start next May and by the end of 1961 business men should be able to dial most of their telex calls to the whole of Western Europe.

Capital expenditure on the development of the trunk and junction network would have to be increased to cope with the rapid growth of trunk traffic. Fourteen major schemes costing about £6 million had been started in the last two years and the bulk of that expenditure would fall in the next two years. A further seven schemes costing about £3 million would be started in the next financial year. The capacity of many of the existing coaxial cable systems would be doubled by providing additional terminal equipment and intermediate amplifiers.

Diesel-Electric Cable Ship Ordered

THE placing of an order with Cammell Laird & Co., Ltd., of Birkenhead, for a new diesel-electric cable-laying ship of about 8,000 tons gross and costing about £1.9 million, is announced by Cable & Wireless, Ltd. They say that this will be the first British cable-laying ship originally designed to lay and handle modern type deep-sea communications cables with repeaters, including the kind to be used in the 28,000-mile Commonwealth round-the-world telephone system. The order provides for construction of the electric propulsion machinery and diesel-engines by the English Electric Co., Ltd., and of the forward cable gear by Johnson & Phillips, Ltd.

The new ship, which will be the first cable-layer to be owned by Cable & Wireless, Ltd., will join the fleet of seven cable repair ships in the summer of 1962. It will have a maximum speed of 16 knots, with a steaming range of 8,000 miles and a sea endurance of 60 days. The carrying capacity will be 1,200 miles of lightweight coaxial telephone cable with repeaters, or 1,500 miles of conventional telegraph cable. A distinctive feature of

the ship will be two funnels abreast, which are needed to allow the extensive cable working spaces to run through the superstructure without obstruction so that cable work can be carried out at either bow or stern.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical

ALUMINIUM ingots	ton	£186	0s	0d
COPPER, H.C. Electro	ton	£280	5s	0d
Fire Refined 99.70%	ton	£217	0s	0d
Fire Refined 99.50%	ton	£216	0s	0d
COPPER Tubes ..	lb	2s	1½d	
Sheet	ton	£251	0s	0d
H.C. wire and strip	ton	£269	15s	0d
LEAD, English ..	ton	£63	15s	0d
Foreign	ton	£62	0s	0d
MERCURY	flask	£69	0s	0d
TIN, block (English) ..	ton	£783	0s	0d
ZINC, G.O.B. Foreign	ton	£79	5s	0d
BRASS Tubes (solid drawn)	lb	1s	9d	
Wire	lb	2s	7½d	
PHOSPHOR BRONZE				
Wire	lb	3s	11½d	
PLATINUM	oz	£30	5s	0d
RUBBER, No. 1 R.S.S. spot	lb	23½d—23½d		

industry. The figures given are the selling prices and are those quoted on Tuesday last.

Television Cameras for Canada

Twelve E.M.I. Electronics image orthicon television cameras and associated equipment are the major items in a \$500,000 contract won by the Canadian General Electric Co., Ltd., for equipment for a new television station in Montreal.

The E.M.I. camera is equipped with a five-position turret, through which the pick-up tube in use can be replaced in a few seconds without opening the camera covers. Other features include facilities for remote control and the fitting of any type of zoom lens, and the use of printed-circuit boards which make for easy maintenance.

INDUSTRIAL NEWS [continued]

CONSUMER PROTECTION

THE Consumer Protection Bill, a private member's Bill under which the Home Secretary can make regulations to ensure the safety of "any prescribed class of goods" and to require that a warning or instructions be fixed to appliances when necessary, had an unopposed second reading last week. Mr. Robert Edwards, the Labour member who presented the Bill, acknowledged assistance from the Home Office in its preparation.

Answering a question earlier about the safety standards of electrical appliances and fittings, the President of the Board of Trade (Mr. Maudling) said he had no reason for thinking British standards unsatisfactory. The British Electrical Approvals Board was due to start approving appliances at the end of February and the enforcement of any new standards would be covered by the Bill.

Large Steelworks Switchgear Contract

FOR their new Spencer Steelworks being erected at Llanwern, Monmouthshire, Richard Thomas & Baldwins, Ltd., have placed a contract with A. Reyrolle & Co., Ltd., for all the 33 and 11 kV switchgear and the 3.3 kV switchgear in the iron-ore processing section.

Four 275/33 kV 75 MVA transformers will be installed to feed the plant through four 33 kV single-busbar metalclad switchboards with cubicle-type control and relay boards. This switchgear will consist of 38 type L42T 1,200 A panels with vertically-isolated oil-break circuit-breakers and six type L45T 2,000 A panels of similar design for the incoming transformer supplies and busbar-section panels. Two of these boards will be in the works main substation, each being fed by two of the transformers with sectionalised busbars. The two remaining boards will be directly interconnected with

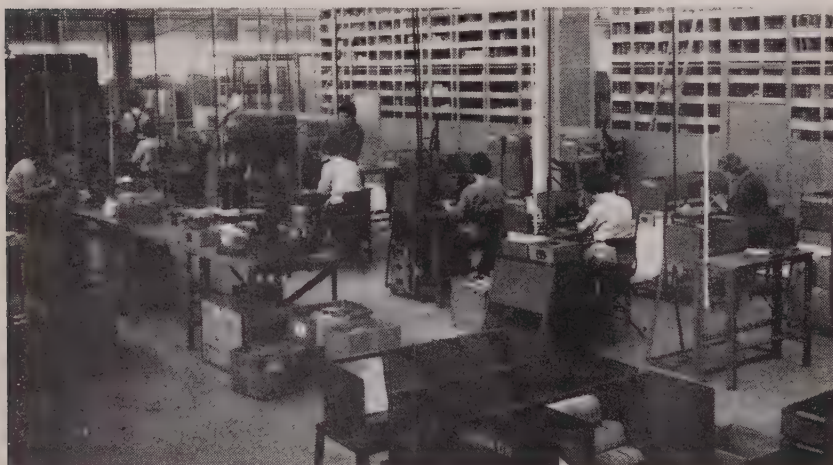
the two boards in the works main substation and will be accommodated in the hot mill and cold mill substations.

These four 33 kV boards will feed the 11 kV primary distribution through 15/21 MVA 33/11 kV transformers and Reyrolle are providing seventeen 11 kV switchboards for this service—191 panels in all. One of these boards, for the main sinter plant substation, will comprise 23 type B6T 500 MVA single-busbar metalclad oil-break circuit-breakers, while the remainder, with the exception of the power house board, will consist of 500 MVA single-busbar metal-enclosed air-break circuit-breakers for the substations associated with central engineering shops, pickle line, steel making plant, hot mill finishing, hot steel mill, temper mill, annealing plant, cold mill and slabbing mill.

The power house board will consist of seventeen 500 MVA duplicate-busbar metal-enclosed air-break switch panels, two of which will control 10 MW alternators, with provision for two future units, and will be interconnected with the works main substation and the sinter plant, slabbing mill and steel making plant substations. The whole of this 11 kV system will be remotely controlled from the works main substation which will also house a central alarms desk.

Secondary distribution is to be at 3.3 kV and Reyrolle are supplying switchgear for a total of 18 substations embodying 176 3.3 kV 150 MVA single-busbar air-break circuit-breakers and 42 oil-break panels.

Leominster Control Gear Factory



Mechanised light assembly lines at the Leominster factory of Contactor Switchgear, Ltd.

BECAUSE their works site at Wolverhampton was fully developed, Contactor Switchgear, Ltd., acquired a 5½-acre site at Leominster a few years ago. Here a modern 25,000 sq ft factory has been built and is now in operation making cubicles and components for electric control gear.

The Mayor of Leominster (Councillor C. P. Goodwin, J.P.), accompanied by members and officials of the Council, recently visited the factory to see how labour from a predominantly agricultural community can be trained to produce electrical equipment. Following the tour of the

factory, the visitors were entertained to lunch by the chairman, Mr. H. Rayner, and directors of Contactor Switchgear, Ltd., at the Talbot Hotel, Leominster.

B.E.A.M.A. GOLDEN JUBILEE DINNER

An outstanding feature of the golden jubilee this year of the British Electrical and Allied Manufacturers' Association will be a dinner to be held on 31st October at Grosvenor House, Park Lane, London. The Prime Minister has been invited as the guest of honour, and has indicated that he will be pleased to attend if he possibly can.

HEATING LIGHTHOUSES

Night storage heaters have been installed in recent months in several lighthouses on the East Anglian coast, including those at Cromer, Happisburgh and Southwold, where the work has been carried out by the Eastern Electricity Board.

Canadian Hydro Order

A contract valued at between \$2,750,000 and \$3,000,000 for three Kaplan-type turbines has been awarded by the Manitoba Hydro-Electric Board to the English Electric Division of John Inglis Co., Ltd., Toronto. When installed at the Grand Rapids generating station on the Saskatchewan River in 1964 the turbines will produce an additional 450,000 h.p. for the Southern Manitoba area. Delivery is to begin in 1962.



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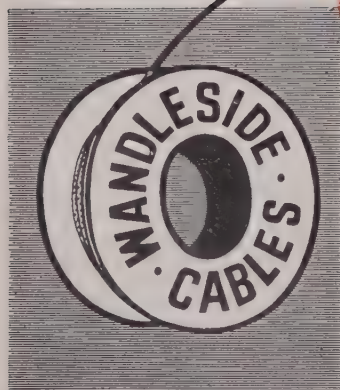
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INDUSTRIAL NEWS *[continued]*

Supergrid Interconnections

SECTIONS of the supergrid in the area of West Thurrock and the Tilbury-Northfleet West Thames crossing are now being completed by the A.E.I. Construction (Cables and Lines) Division. From West Thurrock the A.E.I. construction work covers a 275 kV double-circuit line north-east to Orsett, where a Blaw Knox design type DJX junction tower gives a tee-in to the west circuit of the existing Tilbury-Elstree 275 kV line. The final stage at this point, the transferring of the east circuit to the junction tower and the dismantling of a temporary ST tower which at present carries this circuit, will be carried out later this year.

A spur has been constructed north-west out of the West Thurrock substation to take a future line to Barking and another line runs south from the substation to meet the northern anchor tower of the Thames crossing (described in the 6th January issue of the *Electrical Review*) and continues from the anchor tower on the south side of the river to the new substation at Northfleet West. Jumpering on the anchor towers is awaiting completion of the crossing.

Other work has been carried out on new 275 kV terminations at Elstree and Tilbury, as the Tilbury-Elstree



Circuits of the incoming 275 kV double-circuit line at Tilbury substation are brought into two single-circuit towers

line has been energised at 132 kV since its construction. At Tilbury, also, two new double-circuit 0.4 sq in steel-cored aluminium 132 kV interconnectors have been erected between the 132 kV and 275 kV substations.

Although the length of the new lines amounts to only some $8\frac{1}{2}$ miles of supergrid and $\frac{1}{2}$ mile of 132 kV grid, there are twelve 275 kV ST type towers and four 132 kV DT type terminals towers at the substations.

Satellite Tracking Station

A RADIO installation has been built at Winkfield, Berkshire—known as a Minitrack station—for tracking satellites and recording the measurements from experiments carried by them. Although designed for use with satellites transmitting in the 136-137 Mc/s frequency band, it has already been used for telemetry observations on

108 Mc/s when Explorer 8 was launched last November. The equipment is supplied on loan by the National Aeronautics and Space Administration (N.A.S.A.), which is the United States government department responsible for carrying out the non-military aspects of space research, and it is operated by staff of the Radio Research Station of D.S.I.R.

Until recently there were ten Minitrack stations, mainly in North and South America but including one in South Africa and another at Woomera in Australia. Originally set up to track satellites having orbits at comparatively small inclinations to the equator, this network is sited in low latitudes.

The Winkfield installation is one of four additional stations to provide cover on satellites having orbits with higher inclination angles. A teleprinter circuit to the Goddard Space Flight Centre of N.A.S.A. is used to convey summarised results from each satellite transit observed.

Electrical Equipment for Norwegian Tanker

MOST of the auxiliaries in the 20,000 d.w.t. motor tanker *Montana*, built by Sir James Laing & Sons, Ltd., of Sunderland, for a Norwegian shipping concern, are electrically driven, power being supplied by three G.E.C. Accurex-controlled self-excited alternators. The G.E.C. has also been responsible for the combined main and group starter switchboard and for over 30 electric motors of $1\frac{1}{2}$ to 68 h.p. Two of the alternators are 330 kW, 440 V three-phase 60 c/s diesel-driven machines, while the third, of 300 kW, is turbo-driven. All are arranged for parallel operation on a fully insulated system.

All the excitation and voltage regulator components of the alternators are static. Except for the main field rectifiers, which are placed in the alternator cooling air stream, the components are mounted in the supply section of the switchboard. Provision

is also made at the main switchboard for feeding a bank of 30 kVA transformers, a 440 V sub-switchboard and three engine-room auxiliary circuits. In addition, there is a circuit-breaker for an incoming shore supply.

Gas Turbo-Generator for Porlock

A third Bristol Siddeley 3 MW gas turbo-generator set has been ordered by the South Western Electricity Board, for installation at Porlock in Somerset. Like the two similar sets already in service at Princetown and Lynton in Devon, this unmanned station will be fully automatic and operated under remote control by telephone from the Board's headquarters at Bristol. The prime mover of the set is a modified version of the "Proteus" turbo-prop aero-engine rated at 4,250 h.p.

Board's New South Shields Offices

Work has started on the erection of offices and workshops at Newcastle Road, South Shields, for the North Eastern Electricity Board. The buildings, designed by L. J. Couves & Partners, Newcastle-on-Tyne, are being built by Kendall Cross, Ltd., Ponteland.

INDUSTRIAL NEWS *[continued]*

Towards Better Office Lighting

AFTER many unsuccessful attempts, legislation governing working conditions in offices has now reached the Statute Book, and comes into force on 1st January, 1962. An important part of the regulations that will be formulated under the Act will concern levels of lighting.

To illustrate what they consider to be "good" office lighting, the British Lighting Council have arranged a small exhibition at their demonstration centre in Lancaster Place, London, W.C.2. The exhibition also aims to bring home to the electrical industry the scope for expanding business in office lighting.

An example of a "good" office has built-in lighting arranged to provide three stages of illumination, 30, 40 and 70 lm/ft². The first stage is designed to meet the anticipated new recommendations of the Illuminating Engineering Society for general office work and the others indicate the sort of progress the British Lighting Council expects to see over the next few years. Alongside this exhibit is a typical and all-too-familiar example of bad office lighting. But even in this the level of illumination is actually greater than the 8 lm/ft² found to be the average in a survey carried out in 1948.

That the I.E.S. recommendations are no more than a minimum is well illustrated by experience with what is probably the most effective exhibit. This is a room in which visitors can adjust the amount of light from the luminous ceiling to the intensity, between zero and 400 lm/ft², that they prefer for carrying out various office

An example of good office lighting at the British Lighting Council's exhibition. Three forms of luminous panel are used to give shadowless lighting in all working positions and warm pastel colours are used in the decoration



tasks such as reading, typing and filing. So far the most popular choice has been for around 200 lm/ft² and a good many people ask for the maximum or more.

It may be noted that the Illuminating Engineering Society of America recommend 100 to 150 lm/ft² for office lighting.

Increased F.D.M. Trunk Circuits

NEW terminal equipment and the reduction of the distance between amplification points from six to three miles have enabled the G.P.O. to increase the capacity of the frequency division multiplex (F.D.M.) trunk system between Oxford and Birmingham to carry 2,700 telephone circuits over two coaxial pairs in place of the previous maximum of 960. As an alternative, the new system can carry 960 telephone circuits and a high quality television transmission. Similar systems are now being installed between London and Oxford and Bristol and Cardiff.

At the terminal stations, the telephone channels are stacked into the line frequency band of 312 kc/s to 12.34 Mc/s by up to four stages of frequency changing. At each amplifying point the gain is controlled automatically to compensate for the effects of changes of temperature of the cable. Overall additional automatic regulation is provided to compensate for the effects of temperature changes of the amplifiers and to deal with the effects of valve ageing.

Power for the intermediate stations

is fed along the same conductors as carry the speech signals and up to 13 stations can be fed from any power feeding point. The Oxford-Birmingham route is fed with power from the terminal stations only, the voltage applied being 1,000-0-1,000, giving 2,000 V between conductors.

Interlocking key controlled switches are used to ensure the safety of staff working on the equipment and cables, and a comprehensive system of alarms ensures that any fault condition, and its position, is brought immediately to the notice of the staff at the terminal stations. The Oxford-Birmingham and London-Oxford line systems were designed and manufactured by Standard Telephones & Cables, Ltd., and the Bristol-Cardiff system by the Automatic Telephone & Electric Co., Ltd.

SAFETY ON CONSTRUCTION SITES

The Minister of Labour has appointed Mr. G. G. Honeyman as Commissioner to hear objections to the Construction (General Provisions) Regulations and the Construction (Lifting Operations) Regulations which were published in draft on 28th October, 1960. The inquiry, which will be in public, will be opened on 27th February at No. 10, Carlton House Terrace, London, S.W.1. Notifications of the names of persons or representatives likely to appear at the inquiry should be sent to the secretary, Mr. A. F. Hatfull, Safety, Health and Welfare Department, Ministry of Labour, 19, St. James's Square, London, S.W.1, not later than 10th February.

Price Increases

Contact Switchgear, Ltd., have increased the prices of their control gear by 6½ per cent as from 30th January. Orders against valid outstanding tenders will be accepted up to 28th February and, if for export, up to 30th March.

Wire Works Furnaces

Efco Furnaces, Ltd., have received orders for further extensions to their furnace installation at the United Wire Works, Ltd., Edinburgh. The orders cover the supply of a 200 kW pit pot furnace for bright annealing 8 ton charges of phosphor bronze wire and a bell furnace installation with two furnaces and eight bases. The bell furnaces will also be rated at 200 kW and every base will provide a loading space 48in in diameter by 60in high and accommodate charges weighing up to 10 tons.

Southern Board to Raise its Charges

THE tariffs of the Southern Electricity Board are being revised to provide an increase in total revenue of about 10 per cent. The new charges, which will take effect from the date of the first normal meter reading following 31st March, have been accepted by the Consultative Council.

The secondary rate of the domestic, farming, and commercial and miscellaneous block tariffs will be increased from 1½d to 1¾d/kWh. In the commercial and miscellaneous tariff, the primary assessment for lighting will be reduced and that for space heating slightly increased. There will also be a reduction in the primary units for lighting in the farming tariff. The alterations in the maximum demand tariff will take into account the changes made in the bulk supply tariff since October, 1957, the date of the last general revision of the Board's charges.

SCOTTISH ELECTRICIANS' WAGES

FOLLOWING the settlement of new rates for electricians in England and Wales, agreement has now been reached between the Electrical Trades Union and the Electrical Contractors' Association of Scotland. This provides for an increase of 8d an hour on the standard rate, from 5s 2d to 5s 10d, operative from 1st March, and a further increase of 4d an hour, from 5s 10d to 6s 2d, as from the first full pay period after 31st December next. The rate for armature winders from 1st March will be 5s 11d and after December, 1961, 6s 3d an hour. Unlike the settlement with the N.F.E.A., existing conditions relating to overtime and site conditions remain unaltered.

It has also been agreed to increase the out-working allowance by 6d a day, to 10s a day and £3 10s a week.

E.L.F.A. Luncheon

The annual luncheon of the Electric Light Fittings Association is again to be held at the Tallow Chandlers' Hall, London, E.C.4. The date is 15th March.

Cables to Replace Overhead Lines

The Eastern Electricity Board is to remove the overhead lines and wires from the main street of Burnham, in Essex, and replace them with an underground system.

TRADE ANNOUNCEMENTS

The following changes have recently been made in the sales staff of **Burco, Ltd.**:—Mr. J. Cropper, formerly responsible for retail sales development, has been promoted to field sales manager; Mr. A. C. D. Burbidge, formerly area manager for the North-West, has been promoted southern divisional sales manager and will be responsible for all sales matters and staff in London, the Southern and South Western counties, East Anglia and South Wales; and Mr. F. A. R. Sturman has been promoted to sales liaison manager at headquarters under the general sales manager, Mr. K. B. Holman. Mr. Sturman was formerly area manager for the South East; this area is now the responsibility of Mr. E. R. Stickley. Four field supervisors have been appointed: Mr. J. A. Prange (London), Mr. J. Power (Midlands), Mr. E. R. Waddilove (Yorkshire) and Mr. J. Wilson (Lancashire).

The Computer Department of **Ferranti, Ltd.**, has established a permanent office in Melbourne where a "Sirius" computer will be installed later in the year. Mr. W. R. Arnott is in charge of the office.

A new company, **Petro Engineering Services, Ltd.**, has been formed to give a service to industry in the design, purchase, manufacture and erection of petro-chemical and medium to heavy engineering plant. The chairman and managing director is Mr. A. C. Wilson, and the registered office is at Longfield House, 18-20, Uxbridge Road, Ealing, London, W.5. There is a branch office at Oak House, Cross Street, Sale, Ches.

As reported in this week's "Personal and Social" section, Wing-Commander A. Strutt has been appointed to the newly created post of general manager of the Electrical Products Department of **James A. Jobling & Co., Ltd.**, makers of "Pyrex." He is to be based at the company's headquarters at Sunderland where a 20-acre site is now being cleared for the construction of a £200,000 electronic components plant. With the Corning Glass Works of New York they have formed an associate company, **Electrosil, Ltd.**, to sell their electrical products.

Easipower Appliances, Ltd., have appointed Mr. Duncan Sinclair, of 59, Stanmore Road, Mount Florida, Glasgow, S.2 (telephone: Glasgow Battlefield 1978), as their Scottish representative with effect from 1st January. Announcing this change in

sales policy, the company state that the reorganisation is being carried out in full co-operation with Wood's Agencies (Glasgow), Ltd., who are continuing to act as their distributing agents up to 31st March.

Additional factory premises in Wimbledon, S.W., have been acquired by the **British Rototherm Co., Ltd.**, Merton Abbey, London, S.W.19. The Wimbledon works will accommodate a machine shop, dial thermometer production unit and bulk stores.

Carron Company, Carron, Falkirk, have appointed Mr. R. Hutton as their representative for the sale of domestic electrical appliances in the North-East England area.

The **Shawford Control Gear Co., Ltd.**, has been formed to import from Italy the "CEMA" range of heavy duty control units, contactors, isolators, timers, latched relays, and pedal, palm and limit switches, etc. The company's address is Midland Terrace, Victoria Road, Willesden, London, N.W.10 (telephone: Elgar 7527).

Five floors of a new 11-storey London building, Berkshire House, at the junction of High Holborn and Endell Street, London, are to be used for office staff of **Philips Electrical Industries, Ltd.**

As from 8th February the address of **Power Connectors, Ltd.**, will be Barry House, Worple Road, Wimbledon, S.W.19 (telephone: Wimbledon 6397-8).

The telephone number of **Simms Motor Units, Ltd.**, and the **Simms Motor & Electronics Corporation, Ltd.**, has been changed to Finchley 2692.

From 6th February the telephone number of the Chronos Works, head office of **Smiths Industrial Division**, will be Gladstone 6444.

Pakistan Scheme Inaugurated

On 27th January President Mohammad Ayub Khan inaugurated the Warsak combined irrigation and hydro-electric scheme on the Kabul River. A substantial part of the cost (about £25 million) is being met by Canada under the Colombo Plan for the economic development of south and south-east Asia. Initially the undertaking will provide 160 MW of power and irrigate about 120,000 acres in West Pakistan; the ultimate power output will be 240 MW.

U.K. Electrical Trade in 1960

EXPORTS by British electrical and allied manufacturers in 1960 were valued at £233.8 million, £2.5 million or 1 per cent more than in 1959. In 1959 they had been 4 per cent more than in 1958, and in 1958 2 per cent less than in 1957.

Last year's total was the highest achieved by electrical manufacturers. Nevertheless, the increase was concentrated on a narrow range of products, and compares with

an increase of 6 per cent in total British exports, and a 7 per cent increase in all engineering products. Exports of non-electrical machinery rose by 9 per cent in 1959 and by a further 14 per cent last year to a total of £638 million. There were increases of between 10 per cent (boilers and steam engines) and 30 per cent (office machinery) in all the main items, except mechanical handling equipment, which fell by 2 per cent.

TABLE 1.—ELECTRICAL EXPORTS

Class	Month of Dec. 1960	Year ended 31st December 1959 1960		Class	Month of Dec. 1960	Year ended 31st December 1959 1960	
	£	£	£		£	£	£
Generating sets:				Cookers	71,432	487,532	538,475
Diesel driven not exceeding 10 kW ...	130,086	1,349,571	1,525,062	Toasters	31,205	233,444	216,117
10 kW to 65 kW	194,078	1,615,503	1,670,299	All other cooking appliances	52,989	495,924	496,001
65 kW to 200 kW	155,850	1,821,752	1,398,064	Parts and accessories	84,215	1,050,564	1,019,057
Over 200 kW	181,501	3,255,702	1,912,262	Space heating appliances	26,843	330,758	348,917
Driven by steam turbines	62,655	807,354	843,299	Water heating appliances	41,105	352,510	343,918
Driven by spark ignition engines, hydraulic turbines or other prime movers ...	137,162	500,058	608,967	Other heating appliances	42,547	339,977	391,199
Generators:				Parts and accessories	126,572	1,009,957	1,102,015
Not exceeding 200 kW	96,375	1,180,619	1,043,207	Irons	109,121	896,616	926,025
Over 200 kW	41,443	993,552	988,273	Arc welding equipment, a.c.	49,426	439,997	543,980
Parts	762,448	8,332,313	7,642,262	D.c.	44,428	607,562	583,847
Motors, complete, other than railway, tramway and trolley-bus:				Resistance welding	26,898	376,806	423,384
Not exceeding ½ h.p.	257,652	2,129,960	2,778,586	Electric furnace plant	105,096	1,019,223	1,140,815
Over ½ h.p. but under 1 h.p.	89,858	606,968	873,643	Magnetos, ignition	12,349	146,571	110,922
1 to 250 h.p.	444,927	5,270,762	5,581,049	Sparking plugs	221,261	2,041,509	2,461,222
Exceeding 250 h.p.	172,936	2,525,501	1,998,688	Electrical appliances for aircraft	357,439	3,810,080	3,448,983
Railway, tramway and trolley-bus motors, complete, and parts of all motors ...	200,388	3,049,374	2,404,117	For motor vehicles	681,745	5,129,603	6,936,626
Starting and controlling gear for electric motors	262,685	3,782,702	3,198,253	For cycles	60,421	473,151	609,670
	3,190,044	37,221,691	34,466,031	Signalling apparatus (incl. traffic signals) ...	186,009	2,324,111	1,488,322
Converting machinery	37,693	587,432	782,139	Instruments, commercial	199,493	2,037,599	2,257,923
Mercury-arc rectifiers	71,823	797,255	532,800	House service meters (electrical) incl. parts	189,422	1,683,817	1,829,018
Transformers for lighting, heating and power (including coils):				Electro-medical apparatus (excl. deaf-aids and X-ray apparatus and batteries) ...	44,215	405,319	531,322
Not exceeding 7,500 kVA	446,371	5,216,186	5,279,954	X-ray apparatus (excl. tubes and valves) ...	49,041	591,731	624,082
Over 7,500 kVA	298,983	5,932,786	3,492,828	Ceiling fans	81,970	948,644	984,256
Switchgear and switchboards (excluding telegraph and telephone):				Desk fans and parts of desk and ceiling fans	54,250	285,429	378,352
Switchgear up to 200 A and not exceeding 660 V	495,230	4,220,746	5,205,322	Vacuum cleaners	259,862	1,716,838	2,220,685
Other	1,269,023	14,011,694	12,969,630	Floor polishers	83,692	855,063	816,061
	2,619,123	30,766,099	28,262,674	Food mixers	152,633	844,847	881,842
Batteries and/or cells, primary:				Hair clippers and dry shavers	133,097	761,003	1,348,385
For all lighting purposes	130,508	1,194,297	1,345,608	Other portable appliances	78,764	286,644	493,860
For radio	436,992	4,249,451	4,881,718	Parts	215,825	1,656,677	2,325,888
Other	44,731	434,615	507,840	Portable elec. tools, incl. parts*	337,877	2,579,026	3,176,251
Parts (excl. carbons)	91,591	593,512	706,782				
Lamps:				Telegraph and telephone cables and wires:			
Filament, exceeding 28 V	108,066	1,095,161	1,181,787	Submarine	9,090	4,140,769	1,587,354
Not exceeding 28 V	30,634	351,195	363,189	Other	293,148	4,523,283	3,807,390
Arc lamps, complete*	10,258	180,650	110,828	Other descriptions:			
Discharge lamps, luminous tubes, fluorescent tubes, etc.	127,105	1,082,401	1,125,155	Cotton, silk or man-made fibres insulated	44,969	241,671	331,175
				Enamel, glass or asbestos insulated ...	191,611	1,125,055	1,530,436
Radio and television, etc., apparatus:				Paper insulated	479,704	6,411,855	6,329,529
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury-arc rectifiers), photo-electric cells (excl. photo-transistors), stabilising and cold cathode valves, magnetrons, klystrons ...	55,915	496,408	659,387	Rubber insulated	288,629	3,457,909	3,108,310
Cathode ray tubes	36,604	792,005	592,908	Thermoplastic insulated	284,462	3,112,502	3,556,974
All other*	582,186	5,014,899	5,185,178	Other	245,605	1,966,336	2,378,934
Parts (excluding glass bulbs)	38,954	381,397	638,371		1,837,218	24,979,380	22,630,102
Broadcasting and television transmitters ...	111,994	1,079,762	960,072	Accumulators for motor vehicles	130,789	1,668,358	1,551,676
Communication and navigational and radar equipment	1,407,949	19,446,159	17,202,793	For traction purposes	28,913	229,643	246,712
Domestic receiving sets, mains	57,837	1,008,322	832,305	For radio, and other portable	30,039	396,369	408,913
Battery (incl. complete vibrator sets) ...	74,111	717,200	1,012,733	All other accumulators	50,985	585,420	407,218
Other (incl. mains/battery and car)	26,653	356,867	331,037	Parts and accessories	97,551	1,023,214	1,047,594
Radiograms	28,892	324,336	350,753	Electric wiring accessories	259,779	2,452,610	2,525,496
Television receiving sets	137,597	839,339	1,027,170	Electrical ware (incl. insulators) of ceramic materials, n.e.s.	161,826	1,189,981	1,420,006
Public address equipment	114,249	1,127,409	1,243,593	Industrial electronic control equipment ...	168,598	1,652,586	2,080,754
Other radio and television apparatus, n.e.s.	155,378	916,320	1,551,427	Insulators and insulating materials, n.e.s.: Cloth and tape	83,485	680,704	834,163
Components and parts, n.e.s.	1,120,347	10,079,754	13,663,674	All other	151,465	1,699,292	1,571,485
	3,948,666	42,580,177	45,251,401	Permanent magnets	70,853	571,313	789,445
Telegraph and telephone installations ...	634,070	8,598,178	7,108,830	Radio, telegraph and telephone testing equipment, n.e.s.	108,507	1,497,094	1,611,468
Telephone instruments	164,528	1,285,539	1,987,947	Scientific electrical instruments (excl. telegraphic and telephonic; time recorders and time switches)	489,395	4,226,855	5,445,953
Parts	669,126	9,083,860	7,758,654	All electric machinery, apparatus and appliances, n.e.s.: Machinery	47,676	482,446	456,673
Line apparatus for long distance communication	182,773	2,921,545	2,594,418	Other	1,246,006	10,156,330	12,088,335
	1,650,497	21,889,122	19,449,849		21,562,542	231,343,498	233,766,275

* The figures for 1960 are not completely comparable with those for 1959.

In contrast, of the five main groups of electrical equipment, only that covering valves, radio equipment, etc., showed an increase on the previous year, or indeed on any of the previous three years. Exports of generators and motors fell by 7 per cent last year (no change in 1959); transformers, switchgear, etc., fell by 8 per cent (–2 per cent); electric wires and cables fell by 9 per cent (–5 per cent); and telegraph and telephone equipment fell by 11 per cent (–3 per cent).

The rise of £2.7 million in exports of valves and radio equipment, etc., in 1960 compares with one of £8 million in 1959. The main rise last year was in exports of radio components and parts (+£3.6 million). Exports of

TABLE 2.—DISTRIBUTION OF EXPORTS (TABLE 1)

Country	Month of December 1960	Year ended 31st December 1959	1960
	£	£	£
Gibraltar	14,994	138,786	266,266
Malta and Gozo	47,521	544,610	529,385
Cyprus	80,537	762,764	765,459
Sierra Leone	53,381	415,716	457,261
Ghana	213,357	2,746,060	3,105,306
Nigeria	409,264	5,616,649	5,679,745
Union of South Africa ...	1,258,029	18,871,478	15,305,285
Rhodesia and Nyasaland	983,141	7,530,931	7,640,537
Tanganyika	44,488	548,891	553,947
Kenya	201,323	2,016,296	2,162,917
Uganda	28,932	510,217	401,249
Mauritius	36,753	608,445	808,685
Aden	95,704	585,792	751,745
Bahrain, Qatar and Trucial States	291,834	1,331,699	1,578,265
Kuwait	289,771	2,270,471	2,268,461
India	1,255,485	20,620,081	14,838,699
Pakistan	288,755	2,852,061	3,961,072
Singapore	242,813	2,847,790	2,630,472
Federation of Malaya	354,581	2,624,869	2,673,414
Ceylon	252,374	2,254,855	2,153,518
British North Borneo ...	17,491	552,094	251,016
Sarawak	9,750	150,917	188,404
Hong Kong	494,938	4,758,755	5,060,200
Australia	1,727,902	19,878,749	21,440,544
New Zealand	1,318,776	9,435,911	10,549,322
Fiji	47,836	314,924	263,949
Canada	1,080,172	13,274,411	13,100,703
Jamaica	220,981	1,747,540	2,071,335
Barbados	50,328	360,230	500,400
Trinidad	109,229	1,672,542	1,631,798
British Guiana	45,802	672,157	759,110
Other Commonwealth countries	265,317	2,399,227	2,168,414
Irish Republic	403,709	3,977,565	5,095,953
Soviet Union	21,717	1,336,026	1,411,122
Finland	249,296	1,383,913	2,243,078
Sweden	705,831	5,415,761	6,245,982
Norway	381,043	2,507,315	3,542,061
Denmark	280,590	2,907,408	3,162,164
Poland	56,091	790,339	925,333
Western Germany	782,526	6,148,677	6,728,874
Netherlands	801,687	7,368,662	7,601,602
Belgium	302,302	3,446,939	3,457,273
France	296,900	3,075,141	3,865,844
Switzerland	172,616	2,049,045	1,833,118
Portugal	181,876	2,269,064	2,234,264
Spain	158,175	1,798,592	2,120,726
Italy	452,329	3,667,510	5,056,692
Austria	104,316	536,103	840,974
Yugoslavia	72,312	809,848	1,212,136
Greece	90,511	1,341,849	1,114,281
Turkey	90,686	706,897	1,185,127
Belgian Congo	20,282	678,241	412,188
Portuguese East Africa...	27,601	374,934	530,928
Egypt	72,134	1,598,749	1,105,061
Libya	76,192	813,760	717,395
Morocco (excluding Tangier) ...	21,062	313,298	320,960
Sudan	168,082	1,066,132	1,558,543
Syria	37,951	264,797	415,341
Lebanon	62,297	627,502	655,860
Israel	180,558	1,192,445	1,139,816
Jordan	54,126	889,145	827,340
Saudi Arabia	49,929	606,722	634,446
Iraq	200,383	3,228,564	2,719,103
Iran	184,604	3,648,129	2,457,332
Burma	28,852	1,146,975	587,633
Thailand	111,816	905,706	814,469
Indonesia	256,133	620,264	1,388,177
China	84,773	737,400	1,372,572
Japan	65,431	747,100	763,901
United States of America	967,200	14,561,116	12,505,316
Cuba	3,210	402,760	359,832
Mexico	336,303	609,292	1,523,455
Colombia	19,752	412,811	458,307
Venezuela	119,528	4,611,488	3,175,661
Peru	50,980	375,334	358,310
Chile	60,804	1,020,916	864,818
Brazil	39,876	905,824	533,773
Uruguay	25,367	108,406	260,492
Argentine Republic ...	323,687	2,344,748	4,560,225
Other foreign countries	479,057	4,078,368	4,351,534
TOTAL	21,562,542	231,343,498	233,766,275

TABLE 3.—SOURCES OF ELECTRICAL IMPORTS

Country	Month of December 1960	Year ended 31st December 1959	1960
	£	£	£
Australia	47,668	540,182	459,159
Canada	153,688	1,080,994	1,449,613
Other Commonwealth countries	219,328	1,960,850	2,762,780
Irish Republic	110,963	1,163,391	1,423,784
Sweden	113,059	1,126,149	1,464,039
Denmark	84,218	683,325	893,000
Western Germany	843,558	7,690,762	9,314,700
Netherlands	487,699	6,371,628	7,051,028
Belgium	41,909	519,248	547,245
France	201,087	1,822,024	2,306,801
Switzerland	279,278	1,729,990	2,194,376
Italy	81,269	1,107,585	1,563,391
United States of America	1,620,343	11,409,985	19,733,916
Other foreign countries	307,505	2,981,583	2,791,131
TOTAL	4,591,572	40,187,696	53,954,963

TABLE 4.—OTHER ELECTRICAL AND ALLIED EXPORTS

Class	Month of December 1960	Year ended 31st December 1959	1960
	£	£	£
Domestic electric washing machines incorporating centrifugal water extraction	383,938	4,442,495	3,769,434
Other, with or without wringers ...	342,361	—	3,127,407
Dryers (exported as separate units) ...	33,133	—	409,552
Parts	140,930	975,634	1,494,819
Electric locomotives (incl. battery types)	562,861	5,352,317	4,150,150
Diesel locomotives with electric transmission	—	3,065,313	2,352,151
Welding electrodes: Ferrous	97,697	1,157,463	1,412,070
Non-ferrous	31,426	262,338	318,191
Electric conduit tubes and cased tubes	101,585	767,077	1,042,231
Electric carbons	161,494	1,279,488	1,662,993
Electric lighting fittings and lanterns (excl. arc lamps, searchlights and cycle lamps)	357,165	3,623,214	4,021,337
Electric fork-lift trucks	163,327	966,634	1,354,116
Water and gas turbines, etc.	358,183	4,429,054	5,119,290
Steam turbines	729,829	10,606,742	12,321,370

battery receivers, TV receivers, and public address equipment were also higher than in 1959, but those of mains receivers, broadcasting transmitters and communication equipment were all less; the last by £2.2 million.

Canada replaced India as the best market for these products with shipments rising by over £1 million to £3.6 million. Next in importance last year was the United States, £3.2 million (£2.6 million in 1959); Netherlands, £3 million (£3.2 million); Australia, £2.7 million (£3 million); and Sweden, £2.7 million (£2 million).

In the generators and motors group there were increases in exports of small generators and motors below 250 h.p., and countries which took more than in 1959 included Rhodesia and Nyasaland, Australia, New Zealand and Canada.

In the other groups the falls were more general, but there were increased exports of small transformers and switchgear, telephone instruments and of thermoplastic insulated cables. Among individual items there were increased exports of most domestic appliances, and particularly washing machines, vacuum cleaners, hair clippers and dry shavers; of steam turbines; of electrical equipment for motor vehicles and cycles; of fans; of electro-medical equipment; of wiring accessories; and of scientific instruments.

Of the six largest markets for United Kingdom electrical exports (Australia, India, South Africa, Canada, New Zealand, and the United States) only Australia and New Zealand took more last year than in 1959. Total exports to both the countries of the European Economic Community and to those of the European Free Trade

TABLE 5.—ELECTRICAL IMPORTS

Class	Month of December 1960	Year ended 31st December 1959	
	£	£	£
Generators, incl. parts...	268,327	1,017,106	1,281,027
Motors, incl. parts ...	188,000	1,559,885	2,399,248
Convertors; transformers; rectifiers*	243,620	1,215,871	2,080,333
Switchgear and switchboards (not tele- graph and telephone) ...	124,596	1,115,094	1,855,334
Cathode ray tubes, complete ...	30,913	1,734,390	592,538
Other valves, complete* ...	296,230	2,972,448	4,280,596
Parts (excl. glass bulbs)* ...	69,771	993,571	1,092,264
Radio receiving sets, domestic or portable ...	71,045	409,832	605,952
Radio communication and navigational aids, complete ...	540,348	4,692,904	5,547,923
Other radio and TV apparatus, parts and accessories ...	397,034	3,936,376	4,914,416
Apparatus for telegraphy and telephony	58,719	1,282,764	686,554
Welding machinery ...	78,916	655,492	781,723
Cooking and heating apparatus ...	216,080	1,668,388	2,232,735
Magnetos, ignition, and electric appli- ances for aeroplanes, motor vehicles and cycles ...	263,307	2,374,093	3,684,554
Electro-medical apparatus (incl. X-ray apparatus) ...	82,071	1,007,113	1,157,835
Portable mechanical appliances, elec- trically operated, complete... ..	150,243	1,389,760	1,644,778
Parts ...	56,680	680,623	677,037
Scientific electrical instruments (excl. telegraphic and telephonic) ...	153,829	1,825,509	2,933,819
Other machinery, apparatus and appli- ances ...	301,843	9,656,477	15,506,297
TOTAL ...	4,591,572	40,187,696	53,954,963

* The figures for 1960 are not completely comparable with those for 1959.

Area expanded by about 13 per cent on the 1959 figures, though while the increase for the first group was general, exports to two of the E.F.T.A. countries (Switzerland and Portugal) declined. Total U.K. electrical exports to the E.E.C. were £26.8 million against £17.7 million to the E.F.T.A.

Imports

Electrical goods were imported into the United Kingdom last year to a total value of £54 million, or 34 per cent more than in 1959. Imports of capital goods (electrical machinery and plant, generators, motors, transformers and switchgear) increased at well above the average rate, namely by 55 per cent.

The principal suppliers in 1960 were the United States, Western Germany and the Netherlands, all of whom achieved a substantial increase on their 1959 totals.

Machine-Tool Control

A DISCUSSION which took place at a meeting of the Measurement and Control Section of the Institution of Electrical Engineers on 24th January was concerned with the electronic and mechanical problems associated with machine-tool control. In his opening remarks, Dr. E. H. Frost-Smith said that both the electronic and machine-tool industries had, over the past 6-7 years, devoted a considerable amount of effort to the application of electronic control to machine tools. However, from the user's point of view and particularly when using tape control, there were still many unknowns, especially in relation to the type of organisational changes which had to be made as an essential part of the economic use of such systems.

Before the use of electronic equipment could become general in the machine-tool industry, a good deal more had to be known about the problems of reliability, maintenance and the optimum balance between reliability and other factors such as capital outlay, economics of produc-

tion, performance and so on. This optimum would, of course, be different for different types of control system and for different jobs, and there was insufficient information of this kind available at present.

Electronic systems for co-ordinate positioning for instance, tended to be cheaper when basic measurements were referred back to a machine-tool leadscrew, but many mechanical problems were raised, not only associated with screw pitch errors. When counting was employed as a basic method of measuring distance traversed, again simplicity could be achieved but mechanical problems were often raised and a fair amount of reliability had to be invested in the "electronics."

Much could be done to improve performance and reliability by making use of recent mechanical advances on the machine tool, such as dimensional accuracy, stiffness and damping of the structure. In general, a part of the machine-tool structure was necessarily outside any automatic control loop which might be present and a point had to come when attention to this was more beneficial than attention purely to the accuracy of the closed loop.

Much could be done to reduce backlash and static friction in moving members by the use of hydrostatic pressure pads providing controlled lubrication to moving surfaces. All too often, the specification for a control system was written around an existing machine. This imposed constraints on the overall concept which could be the cause of lower performance in terms of speed and accuracy and higher complexity in the system leading to greater cost and often less reliability.

Letter to the Editor

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Engineers' Salaries in Jamaica

I HAVE recently returned to the United Kingdom from Jamaica and am concerned to note that posts in Jamaica are being advertised at salaries considerably below a level which would represent a fair return to a qualified engineer called upon to work in the conditions which exist in the island at the present time.

As a first approximation, an appointee would need twice the salary he would expect to receive in the United Kingdom, but he should make very careful inquiries regarding the price of foodstuffs, the great majority of which are imported and are below the quality he may be used to. Housing, too, is expensive and a quite inferior house costs around £500 per annum in rent. For a reasonable establishment he would have to pay £720.

Income tax is heavier than in the United Kingdom because of two factors: firstly, there is no earned income relief on the same basis as the two-ninths in the United Kingdom and, secondly, mortgage and other interest payments do not rank for relief.

Should any engineers be contemplating accepting an appointment in Jamaica I would be pleased to advise them on conditions and to give them addresses to which they might write to obtain information direct from the island.

Harborne, Birmingham, 17.

J. P. WESTON.

Contracts have recently been placed for the second stage in the proposed round-the-world Commonwealth telephone cable system from Vancouver to Sydney, via New Zealand and the Fiji Islands. Over 8,000 miles of cable will be required for this section, mostly of the unarmoured type formed round a non-twisting steel core, and 335 submerged repeaters



The approximate route of the "Compac" trans-Pacific telephone cable

Trans-Pacific Telephone Cable

REFERENCE was made in last week's issue to orders recently placed by Cable & Wireless, Ltd., covering cable and other equipment for "Compac," a new trans-Pacific telephone cable due for completion in 1964. The cable route will largely follow that of the 1902 telegraph cable between Sydney, Australia, and Vancouver, Canada, with landing points at Auckland, New Zealand, Suva in the Fiji Islands, and Fanning Island. The total cable length will be over 8,000 nautical miles.

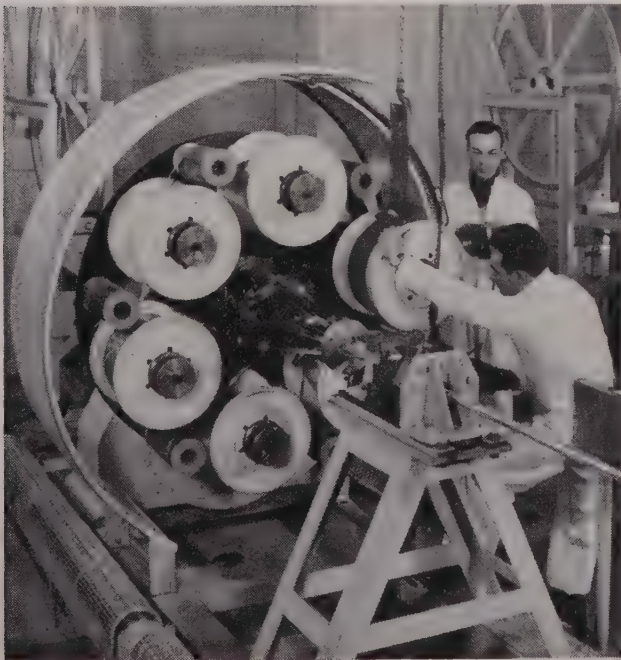
Some 5,875 nautical miles of the cable, 93 of the submerged repeaters and the deep sea housings for all 335

repeaters will be supplied under their £10 million contract by Submarine Cables, Ltd. (owned jointly by Associated Electrical Industries, Ltd., and British Insulated Callender's Cables, Ltd.), while the remaining 2,800 miles of cable, 242 repeaters and all the 38 submerged equalisers will be manufactured by Standard Telephones & Cables, Ltd., on their £9 million order. The orders have been placed by Cable & Wireless, Ltd., on their own behalf and also that of their partners, the Overseas Telecommunications Commission (Australia), the Canadian Overseas Telecommunication Corporation and the New Zealand Post Office. The project, costing an estimated total of some £26 million, is under the general control of the Pacific Cable Management Committee composed of representatives from the four Commonwealth partners (Australia, Canada, New Zealand and the United Kingdom).

Link with "Cantat"

The cable will be the second link in the proposed Commonwealth round-the-world cable system, the first being the "Cantat" cable due for service this year. This will join the United Kingdom to Canada via Newfoundland and be joined by a microwave link across Canada with the Vancouver terminal of the "Compac" system. Like "Cantat," the new Pacific cable system will have a bandwidth equivalent to 60 two-way speech circuits spaced 4 kc/s apart or their equivalent using other types of frequency multiplex equipment (e.g. 80 circuits using 3 kc/s channel equipment).

Only some 270 nautical miles of the cable will be laid in shallow water and require armouring for protection against possible damage by ships' anchors or fishing trawls. The deep sea cable, laid at depths up to 3,500 fathoms, will be of the unarmoured or "lightweight" form proposed by the United Kingdom Post Office and developed in collaboration with Submarine Cables, Ltd.

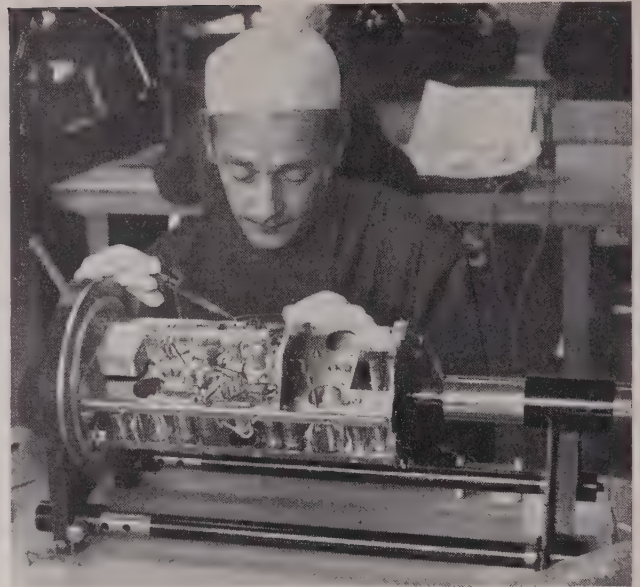


Forming the coaxial outer conductor of six aluminium tapes over the extruded core of the lightweight cable

The mechanical strength required in the cable for laying is provided, not by conventional outer armouring, but by a central high-tensile steel wire strand. This is surrounded by a copper tube forming the central conductor which is then insulated with polythene to a diameter of 0.99in. Aluminium tapes forming the outer conductor are laid over the polythene, followed by a polythene binder tape and a single aluminium screening tape. The whole is given a lapping of anti-corrosion tape followed by an outer sheathing of polythene, producing an overall diameter of 1.3in. The conventional type of cable has a tendency to transmit torsion to the repeaters during laying, whereas the lightweight cable does not, enabling the repeaters to be laid at greater depths.

The inner copper conductor and the outer aluminium tape conductor together comprise a communication cable of coaxial form to carry the currents at frequencies ranging from 60 to 608 kc/s. The inner conductor also carries a direct current which passes along the cable and through each repeater in succession, returning via the sea, to energise the valves in the repeaters. The voltage required at each end of the cable to maintain this current will be about 5,000 V for the longest section.

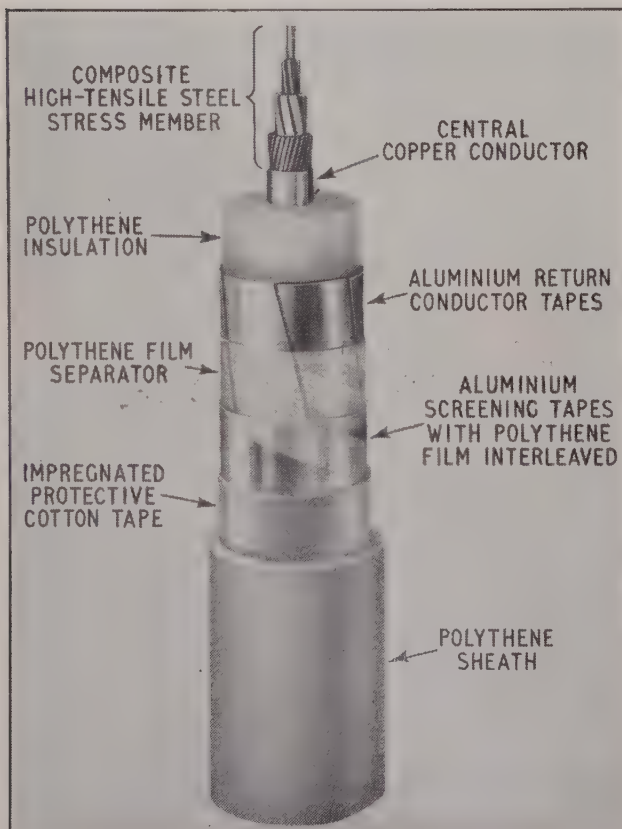
The submerged repeaters will be inserted in the cable at intervals of about 26 miles. Each consists of an amplifier, which amplifies all the conversations simultaneously in both directions, together with other electrical units such as filters, equalisers and supervisory apparatus. In each repeater are over three hundred electrical components assembled in brass or copper containers to form about eight units mounted in a framework of "Perspex" bars and enclosed in a hermetically sealed thin brass



Wiring a submerged repeater amplifier unit

tube. This is then inserted in a thick steel tube housing capable of withstanding sea-bottom pressures up to 5 or 6 tons /sq in.

The two ends of lightweight cable which have to enter a repeater are armoured for a few fathoms each side of the repeater so that the tension in the central strand may be transferred through the various layers of tapes and polythene to the armour wires (or those of the conventional armoured cable used in shallow water) anchored in clamps at each end of the repeater housing. Each completed repeater is about 10ft long, 10½in in diameter and weighs half a ton.



Cut-away section of the unarmoured lightweight cable

Graduate Courses in Engineering

DETAILS have been announced of two graduate courses at Birmingham University. One, on "Information Engineering," will be on the same general syllabus as for 1960-61. The other, at present entitled "Theory of Electrical Machinery," will in future be known as "Electrical Machines: Electromechanical Energy Conversion and Automatic Control." Both courses last twelve months starting on 1st October next and students who already hold a first degree of an approved university may qualify for the degree of M.Sc. by examination.

The course on electrical machines deals with electro-mechanical energy conversion, in which the exploitation of magnetic and electrical fields in electromechanical transducers, the limitations of specific output imposed by properties of materials, heat transfer and the commutation process are described; and the analysis of rotating machines, describing generalised circuit equations, the calculation and measurement of inductances and other parameters and dynamic characteristics. Students may then study either the electrical properties of materials dealing with the theory and application of magnetic materials, dielectrics and semiconductors; or the logical principles, basis of design and applications of analogue and digital electronic computers. The syllabus also covers automatic control systems. The fee for this course is £81 and inquiries should be addressed to the Graduate Course Supervisor, Electrical Engineering Department, The University, Edgbaston, Birmingham, 15.

Indian Railway Electrification

ELECTRIFICATION of the Indian Railways at 25 kV, 50 c/s has been approved for the Durgapur to Mughalsarai section of the Grand Chord of the Eastern Railway; Asansol to Rourkela via Sini, Tatanagar to Dangoaposi via Rajkharsawan and Tatanagar to Kharagpur on the South Eastern Railway; part of the Calcutta suburban area; and Tambaram to Villupuram on the Southern Railway. Last year two sections were opened between Rajkharsawan and Dangoaposi with 47 route and 113 track miles and from Asansol to Dhanbad, with a branch line to Pathardih, covering 49 route and 147 track miles.

About 40 route miles from Durgapur to Asansol and Dhanbad to Gomoh will be brought into use during the next few months, while work is well advanced on about 150 miles of the South Eastern Railway which, when completed later this year, will enable all of the traffic to the steel plants at Rourkela, Tatanagar, Burnpur and Durgapur to be electrically hauled. The 2,800 h.p., 1,676 mm gauge locomotives are of the four-axle Bo-Bo type with a total weight of 74 tons and are designed to start and haul a 3,600 ton train on the level. On a section with a ruling gradient of 1 in 200 they will haul 2,300 trailing tons at 30 m.p.h.

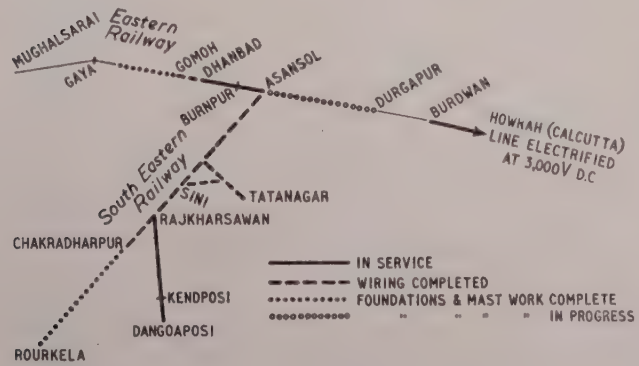
Contracts for the design, supply and erection of the overhead equipment have to date been placed with four contractors, covering about 1,550 track miles. Equipment for some 45 per cent of these, including the first section to be opened, has been provided by the B.I.C.C. group. The overhead equipment consists essentially of a 19-strand cadmium copper catenary, 65 sq mm in cross-section, suspended from cantilever brackets which are swivel mounted on galvanised steel masts. The electrolytic copper contact wire has a cross-section of 107 sq mm and is suspended from the catenary by 5 mm round copper wire droppers. Insulation between the conductors and the masts is provided by a pair of solid core insulators. Special structures, including portals and flexible head spans, are used where a number of tracks have to be



Trial running with a 25 kV locomotive at Kendposi station. The overhead equipment was supplied and erected by the B.I.C.C. Group]

spanned. Practical considerations restrict the runs of catenary and contact wires to about 1,600 metres, and at each end the catenary and the contact wires are anchored. Normally, these conductors are tensioned to 1,000 kg by counter-weights through a system of pulleys. The cantilever bracket which supports the catenary at the mid-section is anchored to adjacent masts to prevent the conductors creeping at this point. At the overlap between adjacent sections the conductors are supported by separate cantilever brackets mounted on common masts, electrical continuity being maintained by jumper connections. Where necessary the overlaps are insulated by omitting these jumpers, but electrical continuity is maintained through an isolating switch which normally remains closed. The isolator switch is mounted on a frame supported on the top of an extended mast.

When the section from Durgapur to Gaya is electrified, there will be five substations and supply feeding points at intervals of 30 to 50 miles. For the Asansol-Dhanbad section, the sectioning posts where conductors fed from different phases are isolated will be situated two miles west of Dhanbad and five miles east of Asansol. Between any two sectioning posts the conductor is further divided into sub-sections and a switching post is set up at the divisions for paralleling the conductor and also to isolate sections for maintenance and repairs. These switching posts are equipped with interruptors remotely operated from the control centre at Asansol. Potential transformers at the switching stations relay the condition of the overhead conductor to the control centre. Lightning arrestors are provided on the masts near the switching posts. The Asansol control centre will ultimately control five 132/25 kV substations and 27 switching stations governing the operation of 116 interruptors over the 193 route miles between Durgapur and Gaya.



Sketch map showing the principal lines being electrified at 25 kV 50 c/s

Power Convention Lecture

The programme for this year's British Electrical Power Convention, reproduced in our issue of 13th January, included a lecture on 14th June by Dr. A. E. Grauer, chairman, British Columbia Electric Co., Ltd. We are now informed that Dr. Grauer's subject will be "The Electrical Power Industry in Canada."

Financial Section

STOCKS and SHARES

GILT-EDGED stocks have plumbed new depths, but prices in the industrial markets of the Stock Exchange have been maintaining their firmness without very much encouragement either from the economic news or from some important company reports of increasing pressure on profit margins. In the field of domestic equipment the effects (never very marked) of the extension of the hire-purchase repayment limit from two to three years faded, leaving the impression that a reduction in the initial deposit on h.p. sales would be much more effective in reviving investment interest in the shares of companies manufacturing items such as refrigerators and washing machines.

G.E.C. Interim

The price of G.E.C. £1 shares hardened a little, to 31s 9d, after publication of the progress report which accompanies the declaration of a 3 per cent interim dividend (as before) on account of the year ending next March. Results from the first eight months' trading, and estimates for the remainder, are said to indicate profits somewhat lower than last year's, the principal reason being the contraction of business in the radio and domestic equipment sections. Changes which have been made to improve administration and strengthen management will take time and effort to prove their effectiveness, but the benefits should begin to become apparent in the year ahead. Dividends totalling 10 per cent have been paid for each of the past three years: the latest of them was covered nearly twice by the surplus of earnings remaining after writing off all research and development expenditure and providing a further half-a-million in respect of the Hunterston atomic energy contract.

Price Changes

In the electrical market, price changes over the week were a little irregular, but with a bias towards the right side. In advance of the coming "rights" issue, I.C.T. put on another 2s 6d, to 73s 9d. British Electronic Industries (the Pye-Ekco merger) remained depressed by Mr. C. O. Stanley's recent warning about the difficulties of the radio industry. Sharp rises in Bakelite and De La Rue were attributed to the excitement of interest

in plastics manufacturers as a result of Turner & Newall's bid for British Industrial Plastics, and the Distillers' offer to British Xylonite. Berry's Electric and Dimplex held firmly to their upward course, and other gains worthy of note included those in

Metal Industries, Allen West, Laurence Scott, and A. H. Hunt.

Company News

Profits of Burco Dean, makers of washing machines and other equipment, were more than halved last

Price Changes in

Company or Board	Nom. Value	Middle price 30th Jan.	Week's Rise or Fall	Dividend		Yield %	1960	
				Pre- vious	Last		High- est	Low- est
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	74		3	3	£ s d 4 1 0	79½	74
Brit. Elec. 1974/77	100	70		3	3	4 5 9	76	69
Brit. Elec. 1976/79	100	72		3½	3½	4 17 3	79½	72½
Brit. Elec. 1974/79	100	82		4½	4½	5 3 9	90½	81
Brit. Elec. 1967/69	100	89½		4½	4½	4 19 0	97½	90
Overseas Electric Supply								
Calcutta Elec.	£1	21/-		7†	7½†	11 14 0	21/-	19/3
East African Power	£1	14/-		8	10	14 5 6	20/3	13/-
Nigerian Elec.	£1	17/-		8	10	11 15 6	19/9	15/6
Perak Hydro-Elec.	£1	18/-		10	10	11 2 0	21/-	15/3
Electrical Shares								
Aberdare Holdings	5/-	14/6		17½	17½	6 0 9	19/-	14/6
Aerialite	1/-	6/9	—6d	54	54	8 0 0	9/6	6/3
Allen, W. H.	£1	37/6	+6d	14	10*†	5 6 9	43/9	34/6
Allied Insulators	5/-	9/-		—	20	5 11 0*	11/6	9/-
Alwyn Holdings	5/-	26/3		—	12½	2 7 6	30/6	17/9
Anglo-Portuguese Tel.	£1	23/9	—6d	9	9	7 11 6	29/-	22/6
Arcoelectric	1/-	4/-		15	15	3 15 0	5/6	3/9
Aron Meters	£1	68/-		15	15	4 8 3	90/-	47/-
Assoc. Elec. Ind. Ord.	£1	41/3		15	15	7 5 6	66/6	39/6
Automatic Tel. & El.	5/-	15/9	—6d	17	17	5 8 0	21/9	14/6
Babcock & Wilcox	£1	31/9		13	9	5 13 3	48/9	32/6
Bakelite	10/-	48/9	+5/9	15	17½	3 0 0*	52/-	33/6
Baldwin, H. J.	2/-	1/6		20	—	—	2/6	1/9
Berry's Electric	5/-	38/9	+1/6	30	30*†	3 17 6	38/6	22/3
Bowthorpe Holdings	2/-	8/-		27	18½*	4 12 6	11/6	7/9
Brit. Elec. Resistance	2/-	6/9	—6d	17½	17½*†	5 3 9	8/3	4/6
Brit. Elec. Traction:								
Def. Ord. "A"	5/-	47/-		35	40	4 5 0	49/3	42/-
Brit. Electronic Ind.	5/-	12/6	—1/3	—	15½	6 0 0	—	—
B.I. Callender's	£1	57/-		13½	13½	4 14 9	61/-	47/9
B.I. Callender's 6% Pref.	£1	18/-	—6d	6	6	6 13 3	21/-	18/6
British Thermostat	5/-	35/-	+2/6	35	20*	2 17 3	32/6	21/3
Brook Motors	10/-	48/6		25	25*	5 3 0	53/6	43/9
Bulgin, A. F.	1/-	9/6		50	55	3 17 3	10/3	8/-
Bulpitts	5/-	17/6		15	16½	4 12 9	23/3	16/6
Burco Dean	5/-	9/6	+3d	18	15	7 18 0	15/9	8/9
Cable & Wireless	5/-	15/9		10	10*†	3 3 6	18/3	14/3
Cambridge Instruments	5/-	32/-		11½†	12½†	3 3 9	33/-	24/9
Chloride El. Storage "A"	£1	73/-	—1/-	20	17½*	4 16 0	81/-	65/6
Clarke Chapman	£1	45/-		13½	13½	6 2 3	63/9	45/-
Combined Elec. Mfrs.	4/-	7/9	—3d	—	12½†	6 9 0	8/6	8/-
Contact Switchgear	5/-	15/-		14	14	4 13 3	17/9	14/6
Cossor, A. C.	5/-	6/9	—3d	5	Nil	—	10/-	5/-
Crabtree	10/-	27/6		20	12½*	4 11 0	39/6	24/-
Crompton Parkinson	5/-	12/-	—3d	14	12½*	5 4 3	15/-	10/9
Davis & Timmins	5/-	31/3	+9d	20*	30½	4 16 0	35/-	17/-
De La Rue	10/-	60/-	+3/6	22½	22½†	3 15 0	78/6	47/9
Decca "A"	10/-	54/-	+1/-	20	23½	4 6 3	51/3	40/9
Desoutter	5/-	50/-		21½	30	3 0 0	50/-	37/6
Dewhurst	2/-	8/3		20	20	4 17 0	8/6	7/-
Dictograph Tel.	2/-	10/-	+6d	20	20*	4 0 0	9/9	7/9
Dimplex	5/-	56/6	+2/-	—	30	2 4 3*	48/-	22/6
Dubilier Condenser	1/-	2/3		25	30	6 13 3*	3/3	2/3
Dupont	5/-	12/9		17½	20	5 4 6*	20/-	12/9
E.M.I.	10/-	43/6	—1/3	20	17½*	4 0 6	58/9	41/9
Eleco	2/-	4/6	—3d	20	20	4 9 0*	4/6	2/6
Electrical Apparatus	5/-	17/3	+6d	14½	20	5 16 0	18/3	12/9
Electrical Components	5/-	9/3		15	11½*	6 4 3	13/9	9/6
Elec. Construction	£1	31/3		9	9	5 15 3	43/-	31/3
Elliott-Automation	5/-	28/-	+6d	9-3	12½	2 3 0	36/-	19/9
Enfield Rolling Mills	£1	47/-	—1/-	15	15	6 7 9	56/-	45/6

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

* After scrip issue.

† Free of income tax.

‡ Dividend indicated.

year, and the dividend is being reduced from 18 to 15 per cent, but in the full report the chairman describes the business as being in a healthy condition and ready quickly to take advantage of any turn for the better in trade. The 5s shares recovered a

few pence to 9s 6d. Westinghouse Brake £1 shares eased further to 37s 6d after the chairman's indication that profits might again contract a little while some of the promising new projects were still in the development stage. Results of L. Sterne, the

refrigerator manufacturing firm, were much in line with earlier forecasts.

Pyrotanax Progress

There is little evidence, in the progress of Pyrotanax, Ltd., of the troubles which have affected some main sections of the cable manufacturing industry over the past year or two. Net profits expanded by a third in the two years 1958-60, and sales are now said in an interim statement to have increased satisfactorily during the first half of the company's silver jubilee year which ends next March. For 1959-60 the total distribution on the ordinary shares was raised from 34 to 40 per cent, and the directors hope to pay at least the same amount for this year. Quoted at 51s 3d, the 5s shares are showing a yield of a fraction under 4 per cent.

Elliott-Automation Issue

With the object of repaying bank loans and providing more working capital, Elliott-Automation have raised the best part of £2½ million by an issue of 6½ per cent debenture stock, redeemable 1981-86, which is now available in the market at an all-in price of about 99½ (transferable free of stamp duty for the time being). Interest on the stock is covered more than six times by average profits of the past three years, and it was anticipated in the prospectus that the accounts for 1960 would show a satisfactory advance on the previous year's figure of £1.36 million. At 28s the 5s ordinary shares stand substantially below the top prices recorded last year, but the growth potentialities with which they are accredited are reflected in a yield of still little more than 2 per cent on the basis of the 12 per cent dividend forecast at the time of last year's acquisition of Rheostatic.

Venner Results

There was a rather sharp fall in the price of Venner 5s shares, to 20s 6d, after the appearance of the company's preliminary statement on the results for the year ended last July. The announcement included a proposal to raise fresh capital by a "rights" issue, of which the details, including the price of the new shares, are to be given out at the end of this month. Profits of £56,000, after tax, compare with £37,000 for the previous period of seven months, and appear therefore, on an annual basis, to have contracted a little, but they provide good cover for the dividend of 13 per cent. There is a yield of about 3½ per cent on the shares, to which investment interest has been attracted in particular by the company's part in the development of parking meters.

Electrical Investments

Company or Board	Nom. Value	Middle price 30th Jan.	Week's Rise or Fall	Dividend		Yield %	1960	
				Pre-vious	Last		High-est	Low-est
Electrical Shares—continued						£	s	d
English Electric ...	£1	32/9	—1/-	14	10*	6	2	3
English Electric 3½% Pref. ...	£1	11/6	—3d	3½	3½	6	10	6
Ericsson Tel. ...	5/-	24/9	—3d	13†	13†	4	5	6
Ever Ready ...	5/-	32/3		27½	20*	3	2	0
Falk Stadelmann ...	£1	23/-	+6d	10	7½	6	10	6
G.E.C. ...	£1	31/9	+3d	10	10	6	6	0
G.E.C. 6½% Pref. ...	£1	18/6	—1/-	6½	6½	7	0	6
General Cables ...	5/-	4/-		15	Nil	—		
Goblin (B.V.C.) ...	5/-	6/-x.d.	—3d	12½	10	8	6	9
Hackbridge Holdings ...	5/-	5/-	—9d	20	20	10	0	0*
Harland Engineering ...	5/-	16/-		14	16*	5	0	0
Head Wrightson ...	5/-	23/-		20	14*	3	0	9
Heatrae ...	2/-	13/9		20	22½	3	5	6
Holophane ...	5/-	18/3		26	30	8	4	6
Hoover ...	5/-	47/-	—6d	60	90	4	14	9*
Hunt, A. H. ...	4/-	19/6	+9d	15	20	4	2	0
Intl. Combustion ...	5/-	30/-		30	30	5	0	0
Intl. Computers & T. ...	£1	73/9	+2/6	10	11½	3	1	0
Johnson & Phillips ...	£1	18/9	—9d	5	Nil	—		
Kenwood Mfg. ...	1/-	6/-		—	—	—		
Laurence Scott ...	5/-	16/9	+1/3	15	15*	4	9	6
Lister, R. A. ...	£1	50/9	+9d	14	14	5	10	3
Lucas, J. ...	£1	63/9		12½	13½	4	6	3
Marryat & Scott ...	2/-	13/9		22½	27½	4	0	0
Mather & Platt ...	£1	45/-	+2/6	10½	11	4	17	9
Metal Industries ...	£1	57/-	+2/-	14	15	5	5	3
Midland Elec. Mfg. ...	£1	60/-		10	12	4	0	0
Murex ...	£1	41/3	—1/3	15	20	5	11	0*
Newman Ind. ...	2/-	5/3		10	12½	4	15	3
Oldham & Son ...	1/-	2/6	+3d	17½	17½*‡	7	0	0
Parsons, C. A. ...	£1	49/3		8½	9½	3	16	0
Philips' Lamps ...	Fl.10	235/-		13-3	17	1	8	9
Plessey ...	10/-	50/3	+3d	15½‡	17‡	3	7	9
Pullin, R. B. ...	2/-	11/6		25	25	4	7	0
Pyrotanax ...	5/-	51/3	+1/3	34	40	3	18	0
Radiation ...	£1	33/6	—1/3	6	12	7	2	9
Reliance-Clifton ...	5/-	24/-		15	15	3	2	6
Reyrolle ...	£1	39/6	—6d	17½	17½	4	8	6*
Richardsons Westgarth ...	10/-	7/-		8½	8½	—		
Sangamo Weston ...	10/-	26/9		12½	11*	4	2	3
Scott, James ...	5/-	26/3	—1/3	24	25*	4	15	3
Simon Engineering ...	5/-	31/-		—	26 6‡	4	6	0
Smith (England), S. ...	4/-	17/6		17½	20	4	11	6
Southern Areas ...	£1	15/-	+3d	Nil	5	6	13	3
Strand Elec. ...	5/-	12/9	+3d	20	14 6*	5	14	3
Sturtevant ...	5/-	15/-	+1/-	15†	15†	8	3	6
Sun Elec. ...	5/-	17/6		15	18½	5	5	9
T.C.C. ...	10/-	41/-		25	35	5	14	0*
Telephone Rentals ...	5/-	24/-		12½	15*	3	2	6
Thompson (John) ...	5/-	15/9	—3d	25	20	6	7	0
Thorn Elec. ...	5/-	46/3		30	25	2	14	0
Thornycroft ...	£1	30/-		6	6	4	0	0
Tube Investments... ..	£1	74/6	+9d	—	14	3	15	3
Ultra Electric ...	5/-	14/3	+9d	20	25	8	15	6
Walsall Conduits ...	4/-	11/9	+6d	22½	15*	5	2	3
Ward & Goldstone ...	5/-	27/3		30	35	3	4	3*
Watford ...	2/-	10/3	—3d	25	25	3	18	0*
Westinghouse ...	£1	37/6	—1/-	11	11	5	17	0
West, Allen ...	5/-	12/9	+3d	12½	12½*	4	18	0
Wilkins & Mitchell ...	5/-	14/9		17	21*	—		
Wolf Electric ...	5/-	15/3	+3d	10	12½	4	2	0

REPORTS and DIVIDENDS

The General Electric Co., Ltd., have declared an interim dividend of 3 per cent (less income tax) for the year ending 31st March next, the same as last year.

The board states that the provisional results for the first eight months' trading and the estimated figures for the remainder of the current financial year indicate that the profit for the year will be somewhat lower than last year, mainly due to reduced trading in the Radio and Domestic Equipment Groups. Trading in other groups has been maintained.

Changes have been made in the company's administrative structure (see page 210), and further steps to strengthen the management are planned. To avoid major disturbances in production and trading, these changes will take place progressively, but it is expected that benefit will begin to appear in the coming year.

Venner, Ltd., announces a dividend of 13 per cent for the year ended 31st July, 1960, representing a 1 per cent per annum rise and a one-for-three rights issue. Full details, including the issue price, will be sent out on 28th February.

Net profits of £56,529 compare with £37,247 for the previous seven months. The directors state that results to date and the volume of orders and inquiries on hand indicate that profits of the group for the year ending 31st July next, should be rather higher than those now announced. If no unforeseen circumstances arise, they expect to be able to recommend a dividend for the current year of not less than 14 per cent on the capital as increased by the proposed rights issue.

Before the issue can be made it will be necessary to increase the authorised capital from £380,000 to £550,000 by the creation of 680,000 ordinary 5s shares.

Burco Dean, Ltd.—The affairs of the company are in a healthy state and, says the chairman, Mr. D. K. Ward, "we can take advantage of any turn in the tide of trade quickly and efficiently."

The latter part of the year to 30th September, 1960, resulted in a stabilising of demand for washing machines, though on a much reduced production schedule to the one planned.

Concurrently with the falling off in demand for the more expensive appli-

ances there was a quickening of demand for the simpler forms of electrical appliances, such as electric wash-boilers, but this, says Mr. Ward, did not offset the loss of volume of sales planned and expected for 1960.

The diminution in the gas division continued during the year, but a new product, the Dean clothes dryer, has been introduced and may result in maintaining the turnover without further deterioration.

Pyrotex, Ltd., is repeating its interim dividend at 15 per cent and hopes to at least maintain for the current year to 31st March next, the same cash dividend distribution as for 1959-60, when the total payment was 40 per cent.

For the first half of the current year, it is stated, product sales of the parent showed a satisfactory increase over the corresponding period last year, and with the exception of the wholly-owned Pyrotex of Canada, which did not achieve its planned output owing to less favourable trade conditions in North America, each group operating company has reported increased returns over the first six months of last year.

Development and expansion of the Australian operating companies has progressed satisfactorily, and this year the group will receive increased benefit from the additional investment in Pyrotex (Holdings) Pty., made in 1960 and referred to in the chairman's statement last year. The associated company, Giles & Elliott, New Zealand, continues to maintain its profitable level of operations.

Despite "the certainty of intensification of competition in the mineral insulated cable field in the future," the directors are satisfied that plans already formulated to increase efficiency and scope should be to the ultimate advantage of all members of the group both at home and overseas.

Permali, Ltd., are paying an interim dividend of 4 per cent, against 3 per cent last year.

New Companies

Overhead Line Fittings, Ltd.—Registered 9th January. Capital £3,000. To carry on the business of electricians and to manufacture and assemble line fittings for overhead transmission lines, etc. Directors: C. W. Allen, A. Wellings and J. Prestwick. Secretary: C. S. Wilson. Regd. offices: Biddle & Co., E.C.2; and Wake Smith & Co., Sheffield, 1.

Fairdeal Domestic Appliances, Ltd.—Registered 16th January. Capital £100. Manufacturers and distributors of, agents for and wholesale and retail dealers in and repairers

of electrical goods of all kinds, radio and television receivers, etc. Directors: C. Thomas and Mrs. Peggy W. Thomas. Secretary: Androula Pitsilides. Regd. office: 435, Liverpool Road, N.7.

Modern Fluorescent, Ltd.—Registered 16th January. Capital £1,000. Manufacturers of and dealers in fluorescent tubes, etc. Directors: D. Marshall and Jean Hopkin (secretary). Regd. office: 21, Kingsway, Thurnscoe, nr. Rotherham.

E. Levitt, Ltd.—Registered 13th January. Capital £100. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Directors: E. Levitt (secretary) and Mrs. Liese L. C. Levitt. Regd. office: 18, Archers Court Road, Whitfield, nr. Dover.

A. E. Hughes & Sons, Ltd.—Registered 13th January. Capital £40,000. Electricians, electrical contractors and engineers, radio and television engineers, etc. Directors: P. S. Hughes (secretary) and W. T. Hughes. Regd. office: 28, Clarence Place, Newport, Mon.

Eastern Modern Electrics, Ltd.—Registered 12th January. Capital £100. Manufacturers of and dealers in vacuum cleaners, etc. Secretary: S. H. Lucas. Regd. office: 6, Surrey Street, W.C.2.

E. W. Aspden, Ltd.—Registered 12th January. Capital £2,500. Electrical engineers, etc. E. W. Aspden and H. C. Smith are the first directors. Regd. office: 151-153, Red Bank Road, Bispham, Blackpool.

G. F. Tuffin, Ltd.—Registered 12th January. Capital £2,000. Electricians, etc. Directors: G. F. Tuffin (secretary), T. A. Tuffin and D. G. Fairhead. Regd. office: 100, Luton Road, Harpenden, Herts.

Leonard S. Gunn (Thundersley), Ltd.—Registered 15th December. Capital £1,000. Electrical engineers, etc. Directors: L. S. Gunn and Ethel M. Gunn (secretary). Regd. office: 331, London Road, Thundersley, Essex.

Danforth Electrics (Edgware), Ltd.—Registered 19th December. Capital £1,000. Manufacturers of and dealers in vacuum cleaners, etc. Directors: W. G. Despard and P. G. Sbardella (secretary). Regd. office: 10, High Street, Edgware.

Northern Cable Construction Co., Ltd.—Registered 8th December. Capital £1,000. Directors: P. F. Wrighton and Mrs. Barbara J. Wrighton (secretary). Regd. office: 11, Blandford Road, Teddington, Middlesex.

Cronin Domestic, Ltd.—Registered 12th December. Capital £1,000. Electrical engineers and contractors, etc. Directors: W. H. Cronin and May Tompkins (secretary). Regd. office: 44, Binley Road, Coventry.

C. H. Saltmarsh, Ltd.—Registered 23rd December. Capital £1,500. Electrical engineers and contractors, etc. Directors: C. H. Saltmarsh and Mrs. Eva R. Saltmarsh. Secretary: Eva R. Saltmarsh. Regd. office: 17, Lewisham High Street, S.E.13.

Alex-Electrical, Ltd.—Registered 11th January. Capital £2,000. To acquire the business of an electrician and electrical engineer carried on by A. S. McBain at Romford, etc. Directors: A. S. McBain and B. D. Davis. Secretary: Kathleen D. Gearing. Regd. office: 191, North Street, Romford, Essex.

Candell, Ltd.—Registered 12th January. Capital £10,000. Electrical engineers, etc. Directors: B. G. Heath and C. F. Heath. Secretary: A. S. J. Thomas. Regd. office: 312, Broadmead Road, Woodford Green.

Sulcott, Ltd.—Registered 16th January. Capital £100. Electrical engineers, etc. Directors: J. G. Sullivan and J. M. Scott. Secretary: S. G. Scott. Regd. office: 43, Cunningham Park, Harrow, Mdx.

R.W.R. Enterprises, Ltd.—Registered 13th January. Capital £500. Electricians, electrical engineers and contractors, etc. Directors: A. G. Richley, I. G. Richley and L. T. Wood. Secretary: Gladys Richley. Regd. office: 22, Russell Street, Brighton.

W.S.D. Services, Ltd.—Registered 16th January. Capital £100. Electricians, electrical engineers, etc. Directors: K. Sivyier, Mrs. Irene Sivyier (secretary), B. Woosley and

Mrs. Roma Woosey. Regd. office: 174, Herbert Avenue, Parkstone, Poole.

Norlet, Ltd., Nortell, Ltd. and Ornten, Ltd.—Registered 16th January. Capital £100 each. Electrical engineers, etc. Secretary: L. R. Battell, 117, Hart Road, Thundersley, Essex.

H. & E. Lintott (Electronics), Ltd.—Registered 30th December. Capital £100. Electronic engineers, etc. Directors: F. H. Ayling and F. P. S. Stammers. Secretary: Kathleen M. Wright. Regd. office: Ayling House, King's Road, Horsham.

Bronte Electric Blanket Co., Ltd.—Registered 30th December. Capital £100. Secretary: J. P. Davisson, 65a, Fenchurch Street, E.C.3.

F. C. Adler, Ltd.—Registered 30th December. Capital £1,000. Manufacturers, importers and exporters and distributors of, agents for and dealers in electrical goods of all kinds, radio and television receivers, etc. A. Adler is the first director. Secretary: Sheila A. Ferguson. Regd. office: 3, Oxford Street, W.1.

Crossley Gates, Ltd.—Registered 30th December. Capital £1,000. Manufacturers of and dealers in electrical gate and door control equipment, etc. Directors: I. Ross and G. Crossley. Secretary: Mary Ross. Regd. office: City Works, Ackroyd Street, Morley.

Frank Early, Ltd.—Registered 30th December. Capital £100. Electrical engineers and general electrical installation contractors, radio and television engineers and service agents, etc. Directors: F. V. Early, Mrs. Marian R. Early, Marion Early, R. Early and Jane Early. Secretary: F. V. Early. Regd. office: 45, Hawkhurst Road, Coldean, Brighton.

H. Greenfield (Electrical), Ltd.—Registered 28th December. Capital £1,000. Directors: B. Levy (secretary) and Mrs. Irene A. Levy. Regd. office: 31½, Haymarket, S.W.1.

E. Roberts (Electrical Contractors), Ltd.—Registered 29th December. Capital £100. Electrical engineers and contractors, etc. Directors: E. A. C. Roberts and A. O. Roberts. Secretary: S. C. Bawden. Regd. office: 35, Tytherton Road, N.19.

Nottingham Refrigeration, Ltd.—Registered 12th December. Capital £4,000. Directors: D. A. Pascoe and W. M. Stevenson (secretary). Regd. office: Trent Street, Nottingham.

Sane-Wilcox Electrical Engineering Co., Ltd.—Registered 22nd December. Capital £100. Directors: K. Wilcox and Mrs. Hilda D. M. Sane. Secretary: Margaret M. Wilcox. Regd. office: 10, Duke Street, Penn Fields, Wolverhampton.

Gainsborough Television & Electrical Services, Ltd.—Registered 30th December. Capital £100. B. J. C. Gammon, 135/7, Victoria Avenue, Southend-on-Sea is the first director.

Electrical Installations (Kenilworth), Ltd.—Registered 30th December. Capital £100. Electrical engineers, etc. Directors: J. A. McCaughey and Rosemary N. McCaughey (secretary). Regd. office: 30, Bridge Street, Kenilworth.

Commercial Refrigeration & Electrical Co., Ltd.—Registered 30th December. Capital £3,000. Directors: A. D. Anderson and F. R. Smith. Solicitors: Walpole Hillier & Son, Sheffield.

Westbourne Electrical, Ltd.—Registered 12th December. Capital £1,000. Directors: S. W. Lenegan and Mrs. Mary Lenegan (secretary). Regd. office: 8a, Grand Parade, Poole Road, Bournemouth.

Three Shires Electrical, Ltd.—Registered 16th January. Capital £2,000. Manufacturers of and dealers in dynamos, motors, armatures, etc. Directors: T. Skidmore and R. W. Skidmore. Secretary: Rita M. Skidmore. Regd. office: 93, Three Shires Oak Road, Bearwood, Smethwick.

Thornaby Electrics, Ltd.—Registered 17th January. Capital £2,000. To acquire the business of electrical engineers, now carried on by J. Havakin and J. Wilson as "Thornaby

Electrics." Directors: J. Havakin and J. Wilson (secretary). Regd. office: Thornaby House, Thornaby Place, Thornaby-on-Tees, Yorks.

A. & N. Transistor Applications, Ltd.—Registered 16th January. Capital £100. Directors: F. A. Davies, E. J. Mander, A. Cole, A. F. B. Cooke and W. Woods-Hill. Regd. office: Adam House, 1, Fitzroy Square, W.1.

Jackson & King, Ltd.—Registered 17th January. Capital £100. Importers, exporters, manufacturers of and dealers in lighting fittings, etc. Directors: H. F. King and J. F. Jackson. Regd. office: 23, Haslam Avenue, Sutton, Surrey.

David W. Gunby, Ltd.—Registered 17th January. Capital £4,000. Electricians, electrical, radio and television engineers, etc. Directors: D. W. Gunby and Mrs. Jean Gunby. Solicitors: Cranswick, Crawford & Owen, Leeds, 1.

G. Alexander & Partners (Manufacturers), Ltd.—Registered 9th January. Capital £1,000. To carry on the business of electrical, mechanical, electronic, aeronautical, marine, motor, consulting and general engineers, etc. Secretary: Shirley Hart. Regd. office: 52, Brook Street, W.1.

Shoplumination, Ltd.—Registered 5th January. Capital £100. Electrical engineers and designers, suppliers, erectors, maintainers and repairers of electrical and all types of signs, etc. Directors: D. G. Lowe and R. A. Showell (secretary). Regd. office: King Edward Square, Sutton Coldfield.

Smith Brothers (Easingwold), Ltd.—Registered 6th January. Capital £2,000. To carry on the business of electrical engineers, etc. Directors: H. F. Smith and Enid M. Smith (secretary). Regd. office: The Market Place, Easingwold, York.

Refrigeration Services (York), Ltd.—Registered 17th January. Capital £500. Manufacturers of and dealers in electrical equipment, etc. Directors: F. McGarry, C. G. Croft and C. D. Ardley (secretary). Regd. office: 1, Lord Mayor's Walk, York.

Industrial Electrics (Coventry), Ltd.—Registered 18th January. Capital £500. Electrical maintenance engineers, etc. C. A. Goode is the first director. Secretary: Muriel F. Goode. Regd. office: 9, Queen Victoria Road, Coventry.

Allweld Equipment, Ltd.—Registered 6th January. Capital £100. Manufacturers of and dealers in dynamos, motors, etc. Directors: J. D. Gray and D. W. J. Packer. Secretary: Yvonne P. Evans. Regd. office: 4, Chapel Row, Queen Square, Bath.

Marwin (Electrical) Co., Ltd.—Registered 6th January. Capital £1,000. Directors: R. B. Walford and Mrs. Margaret Walford, and R. S. Cresswell and Mrs. Winifred Cresswell (secretary). Regd. office: 101, Lower Lichfield Street, Willenhall, Staffs.

Audel, Ltd.—Registered 23rd January. Capital £1,000. Electricians, electrical and mechanical engineers, etc. Directors: Mrs. Alma Warhurst (secretary) and W. H. D. Jensen. Regd. office: Meynell Lodge, Quorn, Leics.

High Voltage Accessories, Ltd.—Registered 19th January. Capital £1,000. Electrical engineers and contractors, etc. Directors: P. Mathews, J. R. Ferguson (secretary), G. G. Heys and R. J. Males. Regd. office: 72, Bridge Street, Manchester, 2.

Bradley & Son (Electrical), Ltd.—Registered 23rd January. Capital £5,000. Electrical contractors, etc. Directors: R. Bradley and Audrey Bradley. Secretary: W. J. G. Spencer. Regd. office: 24, Sandbed Lane, Belper, Derbys.

G. H. Taylor & Co. (Netherfield), Ltd.—Registered 23rd January. Capital £5,000. Manufacturers of and dealers in heating elements, etc. Directors: G. H. Taylor and Agnes Taylor (secretary). Regd. office: 32, Meadow Road, Netherfield, Nottingham.

H. B. Talbot, Ltd.—Registered 23rd January. Capital £1,000. Manufacturers of and dealers in electrical goods of all kinds, etc. Directors: H. B. Talbot and Mrs. Violet A. Talbot (secretary). Regd. office: 23, Filey Street, Sheffield, 10.

Receivers Appointed or Released

Howes Swift Electric, Ltd.—Mr. D. J. Martin, of 90, Queen Street, E.C.4, ceased to act as receiver and/or manager on 5th January.

Range Electronics Co., Ltd.—Mr. B. Keane, of 42, Devonshire Street, W.1, ceased to act as receiver and manager on 1st January.

Browns Refrigeration, Ltd.—Mr. A. Bennison, Ashbourne House, Woodlands Road East, Colwyn Bay, was appointed receiver and manager on 22nd December, 1960, under powers contained in debenture dated 30th March, 1951.

Rototast Electronic Controls, Ltd.—Mr. T. Rogers, of 13/14, Great St. Thomas Apostle, E.C.4, ceased to act as receiver on 28th December, 1960.

Benniman & Murray Electrical, Ltd.—Mr. J. B. Sweeney, 27, Martin Lane, E.C.4, was appointed receiver and manager on 23rd December, 1960, under powers contained in a debenture dated 4th November, 1958.

Bankruptcies

N. J. Parkes and J. R. Parkes, formerly carrying on business in co-partnership with another as retailers of domestic appliances under the style of Trivox Electric at 54, Corwen Avenue, Harpurhey, Manchester. (Separate estate of N. J. Parkes).—Last date for receiving proofs for dividend today (Friday). Trustee, Mr. W. H. Meredith, 20, Byrom Street, Manchester, 3.

B. C. O. Renney, electrical retailer, carrying on business at 209, Baker Street, Enfield, Middx.—Receiving order made 19th January on debtor's petition.

A. L. Lankester, 65, St. Thomas's Road, Worthing, building and electrical contractor.—Last day for receiving proofs for dividend 7th February. Trustee, Mr. J. S. Bradley-Hole, 7, Old Steine, Brighton.

D. Roberts and F. J. Webb, carrying on business together as retailers of domestic electrical appliances under the style of Rowe Electrical Services at 130, Foleshill Road and Corporation Street, Coventry.—Trustee, Mr. K. D. Wickenden, Stoneleigh Chambers, 2, Queens Road, Coventry, appointed 17th January.

L. Jacques, formerly carrying on business at 134, Moston Lane, Moston, Manchester, and at 16, Park Road, Preston, as an electrical engineer and dealer.—Public examination 19th April at the Court House, South King Street, Blackpool.

M. Dubb, residing and carrying on business at 204, Boothferry Road, Hull, and formerly carrying on business at 512, Anlaby Road, Hull, electrical contractor.—Receiving order made 16th January on debtor's petition. Public examination 13th March at the Guildhall, Hull.

C. R. Clarke, lately trading at Kingham Way, Luton, as an electrical contractor.—Supplemental dividend of 2½d in the £ payable 7th February at the Official Receiver's Office, 15, Guildhall Road, Northampton.

V. P. Jackson, carrying on business at 311-313, Aigburth Road, Liverpool, as Vincent Jackson, electrical and radio engineer.—Last day for receiving proofs for dividend 7th February. Trustee, Mr. S. O. Henry, 5, Rumford Place, Chapel Street, Liverpool, 3.

W. L. King, lately carrying on business at Central Arcade, Pentrebane Street, Caerphilly, Glam., as a dealer in electrical apparatus.—Receiving order made 19th January on a creditor's petition.

Meeting of Creditors

Wm. Gregory (Electrical Installations), Ltd.—Meeting 9th February at the Bacchus Hotel, Sutton-on-Sea, Lincs.

Liquidation

Reeves Electrical & Radio Co., Ltd., electrical appliance manufacturers, The Old Cinema, 34, Whitehall Street, Baldock, Herts.—Liquidator, Mr. K. R. Cork, 19, Eastcheap, London, E.C.3, appointed 30th December with a committee of inspection.

NEW ELECTRICAL EQUIPMENT

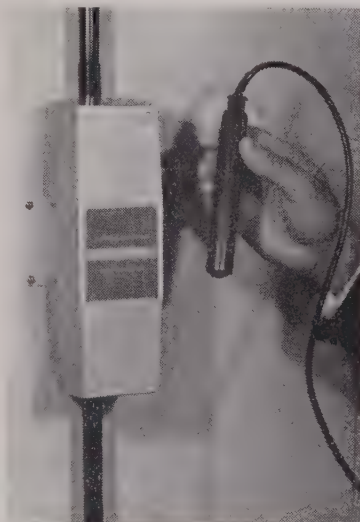
Waterproof Micro-Switch

The waterproof micro-switch, the "Microseal," recently announced by DOWTY ELECTRICS, LTD., Tewkesbury, Glos., is designed to operate at altitudes up to 60,000ft in ambient temperatures ranging from -75 to $+70^{\circ}\text{C}$. The whole unit weighs 7 oz. Sealing is achieved by glass/metal seals interposed between the switch tray and terminal block, together with a silicone-rubber ring and an associated nylon scraper ring in the plunger mechanism. The 6 BA terminals are arranged in a mica-filled, phenolic-resin terminal block and are protected by a synthetic rubber grommet. The switch action consists of a heavy-duty, double-pole, change-over contact arrangement, a rocker carrying moving contact blades and a soft-iron armature moving between two permanent magnets to provide a positive "snap action." A feature of this design is that contact pressure increases up to the moment of change-over. To simplify the striker mechanism design and to allow for flexing structures, the plunger has $\frac{3}{8}$ in overtravel after the switch has operated. A load of $10\frac{1}{2}$ lb maximum is necessary to operate the switch, while a load of 21 lb gives full plunger overtravel. At full overtravel, the top of the plunger is level with the top of the turret, preventing damage to the switch mechanism.

Proximity Detector

A transistorised proximity detector, the "Proximitron" Type S unit, which signals the presence or absence of a metallic object in a given region of space has been introduced by MEC-TEST, LTD., Henrietta House, Henrietta Place, London, W.1. The equipment consists of a sensing element and a control unit. The sensing element generates an alternating field of 2 kc/s frequency in the required region of space and senses the manner in which the field is changed by the introduction of metal. The signal produced is amplified and used to operate relays. The circuit techniques used ensure long-term stability and discrimination against the effects of temperature and vibration. A variety of sensing elements is available including loop coils (which may be buried in the ground), annular coils and probes, which will detect the presence or position of both ferrous and non-ferrous metals. The sensing elements are not affected by the presence of dirt, oils or ink. These units are particularly suitable where

the mechanical actuation of switches is undesirable. The field of detection can range from a fraction of an inch to several feet, according to the type of probe selected. The control unit is of interchangeable plug-in design,

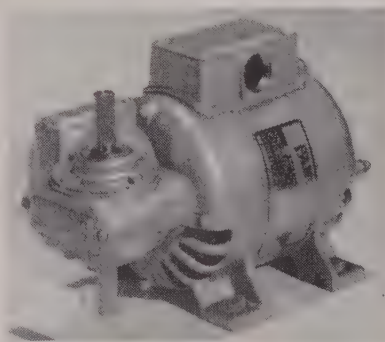


Mec-Test proximity detector with probe type sensing element

housed in a sealed container. The resultant indication may be either relay closure or balanced d.c. pulse.

Geared Motor Units

An extension to their range of f.h.p. geared motor units has been announced by PARVALUX, LTD., Parkstone, Poole, Dorset. Models in the S.D.9 series are of the single reduction type, while the S.D.10 series incorporate double reduction gearing. The new totally-enclosed heavy-duty units give a 50 per cent increase in torque on the previous fan-cooled units at



Parvalux S.D.10 geared motor

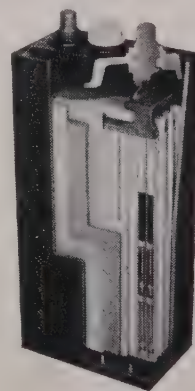
the same motor speeds. Final shaft speeds can be obtained from 700 down to 0.2 r.p.m. and the output torque developed varies according to the type of unit up to 52.5 lb-in. Class E

insulation is used, permitting a temperature rise of 65°C .

The frame comprises pressure die-castings located together or alternatively on the machined spigots of the stator packs, which ensures a concentric air gap with correct bearing alignment. The armature laminations or diecast rotor are pressed into position on a ground steel shaft and the complete assembly (after winding, impregnation and baking in the case of armatures) is statically and dynamically balanced. For connections 12in of p.v.c. flexible lead is brought through a grommet at the rear of the motor, or alternatively the connection can be made through flexible conduit.

Tubular Batteries

High-capacity tubular batteries have recently been introduced by CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2, to complement their standard ranges. These batteries give from 32 to 38 per cent increase in capacity for a given volume over the standard types. In the positive plate the current is carried by



Crompton tubular type cell

vertical spines which are cast integrally with the top connecting bar in a lead alloy, the active material being held in close contact with these spines by finely-woven tubes of a synthetic fibre, immune from attack by sulphuric acid and oxidation. Its fine weave minimises loss of active material yet its high porosity enables the performance to be maintained even at the highest rate of discharge. A conducting lead alloy base plug seals the bottom ends of the tubes and connects the spines electrically, providing an alternative current path if a spine should fracture towards the end of the battery's life. The negative plate is enclosed in an armoured envelope which consists of two sheets of an inert, microporous

synthetic material, joined round three sides by a p.v.c. strip. This enclosure makes it impossible for material which may eventually be shed by the plates to accumulate and cause side and bottom "shorts." The microporous sheets forming the armouring of the negative plate also act as separators.

Ratchet-Free Stepper Motor

A low voltage stepper motor, eliminating mechanical ratchets, has been announced by the A. W. HAYDON COMPANY, Waterbury, Connecticut, U.S.A. It may be operated with the windings continuously energised in static condition or pulsed at rates up to 2,400 steps/min. Since the windings have a low inductance/resistance ratio, the stepper is suited to high speed applications where pulse power is limited.

With one of the two coils in the motor energised, the rotor advances 15° when a changeover switch is transferred to the next position, energising the second coil. Returning the switch to the first position again energises the first coil, advancing the rotor another 15° and completing one pulse cycle. Both coils must be alternately energised to obtain rotation,

and has a capacitance range of 33-6,000 μF (minimum tolerance ± 2 per cent, or $\pm 2 \mu\text{F}$ below 100 μF). Type A25E has the same section but is 1in long and has a capacitance range of 6,000-20,000 μF (minimum tolerance ± 1 per cent). Any capacitance value within these ranges can be supplied. Both types are rated at 50 V peak working.

Although the leads emerge axially they can be adjusted to fit 0.1in or 0.2in module printed circuit boards. The square section permits the cementing of the capacitors to the printed circuit boards if acceleration forces are high.

Clip-on Volt-Ammeters

Three "Junior" models have been added to the range of Amprobe clip-on volt-ammeters available from H. J. BALDWIN & CO., LTD., 221, Grand Buildings, Trafalgar Square, London, W.C.2. The "Juniors" are available in 0-300/600 V models in current ranges of either 0-25, 0-50 and 0-100 A a.c. Accuracy of both voltage and current ranges is ± 3 per cent of full scale, and the readings are obtained on a 1.8in calibrated scale. For current measurement the trigger operated jaws

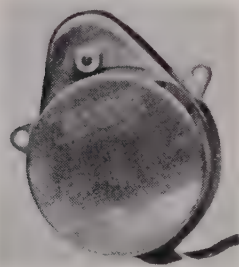
power dissipation ratings, high beta at high current, and can operate up to $+175^\circ\text{C}$. At 100°C they offer a range of dissipation of from 2 to 30 W. They are available in standard JEDEC cans.

The type XC703 has a maximum collector/base voltage of 60 V; a maximum collector current of 1.5 A; and a maximum total dissipation at a case temperature of 100°C of 2 W. The corresponding figures for the types XC713 and XC723 are 60 V, 3 A and 7.5 W; and 60 V, 6 A and 30 W respectively.

Flexible Terminal Block

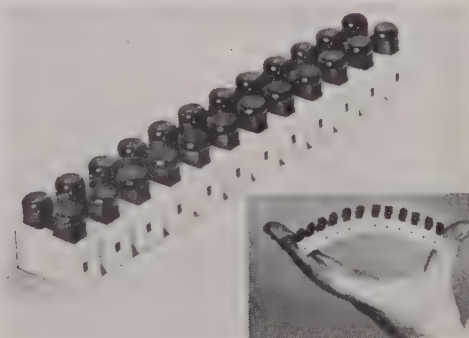
A flexible terminal block (part No. 2024T/12) has been added to the standard range of "Suprafix" spring-loaded terminal blocks manufactured by HELLERMANN, LTD., Crawley, Sussex. This 12-way block is rated at 10 A 380/470 V and incorporates a spring-loaded device which enables a stripped cable end to be inserted when a button is pressed and grips the cable when the button is released. The block can be used with rigid conductors with or without terminals or

Hellermann flexible terminal block



Haydon stepper motor

Amprobe "Junior" clip-on volt-ammeter (H. J. Baldwin & Co., Ltd.)



and consecutive pulses to one winding only will not advance the rotor. Control circuitry is facilitated, since a switch in either pulse lead may be used to interrupt the pulse source and stop rotation. Positive magnetic detenting occurs at each of the 12 angular rotor positions even under vibration conditions and whether or not the coils are energised. Rated at 27 V d.c., the motor has a continuous duty cycle, a rotor step angle of 30° /cycle and a rated load of 0.2 oz-in at 20°C .

Miniature Capacitors

The development of two "Silver Star" capacitors, types A15E and A25E, which are square in section, of very small size and designed specifically for transistorised printed circuitry, is announced by JOHNSON, MATTHEY & CO., LTD., 73-83, Hatton Garden, London, E.C.1. The components are encapsulated in synthetic resin. The type A15E is $\frac{1}{4}$ in square by $\frac{1}{4}$ in long

are clipped round a conductor. Voltage is measured by using plug-in leads clipped to the load. There are two voltage ranges, selected by a button.

Power Transistors

The introduction of three n-p-n diffused junction type silicon power transistors is announced by the Semiconductor Department of the A.E.I. RADIO AND ELECTRONIC COMPONENTS DIVISION, 155, Charing Cross Road, London, W.C.2. Types XC703, XC713 and XC723 are intended for a wide variety of industrial applications in equipment operating at temperatures ranging from -65°C to $+175^\circ\text{C}$, including power-switching circuits, oscillator regulator and pulse amplifier circuits, and as Class A and Class B push-pull audio and servo amplifiers. They are characterised by a low saturation resistance, high current and

flexible conductors with terminations. Special compression terminals have been developed for use with this block.

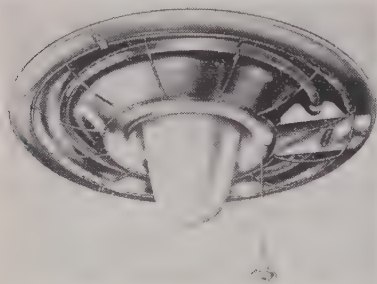
Self-Fluxing Wires

The range of "Lewcosol" solderable enamelled wires has now been extended to include wires down to 0.001in. These are manufactured by the LONDON ELECTRIC WIRE CO. & SMITHS, LTD., 24, Queen Anne's Gate, Westminster, London, S.W.1. Only one grade of covering is at present available for the three sizes produced, 0.001, 0.0012 and 0.0014in diameter. These wires have maximum overall dimensions of 0.0014, 0.0016 and 0.0019in respectively.

Heat-Light Fittings

A combined heating and lighting unit suitable for use in the kitchen or bathroom is now being produced by

THERMAIR DOMESTIC APPLIANCES, LTD., Izons Lane, Oldbury Road, West Bromwich, Staffs. The fitting, called the "Heat-n-Lite," consists of a circular 750 W silica sheathed infra-red element in a highly polished anodised aluminium reflector. In the centre an opalised shade covers the socket for a conventional electric bulb. The heating part of the appliance is controlled by a double-pole pull switch. The maximum depth from the ceiling is 6½ in, including the light-shade, and the unit is 16 in in diameter. The outer casing is enamelled white.



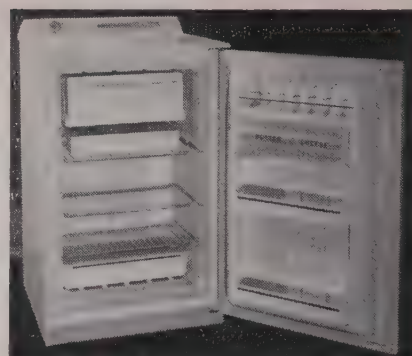
Thermair "Heat-n-Lite" fitting

Models are available for 200-220 or 230-250 V, a.c. only. The price, including purchase tax, is £7 19s 6d.

Domestic Refrigerator

The latest "Astral" absorption type refrigerator to be introduced by **MORPHY-RICHARDS (ASTRAL), LTD.**, 50, Conduit Street, London, W.1, is the model A.350 with a capacity of 3.5 cu ft. A table-top refrigerator, it is designed on square-cut lines and has a vitreous enamelled working surface with a splash guard at the rear. The door has a magnetic seal, and is fitted with an egg rack, a butter and cheese compartment, and two adjustable shelves for storing jars, milk bottles, etc. On the standard model the door opens from left to right, but an alternative opening will also be available. Adjustable feet are fitted to the cabinet for levelling the refrigerator.

The refrigerator interior has three adjustable shelves, chromium-plated with a gilt trim, and a cooling unit which stores up to 15 lb of frozen foods. Three ice trays are provided



Morphy-Richards model A.350 "Astral" 3.5 cu ft refrigerator

for making 36 cubes (1.65 lb of ice).

Other fittings include a chiller, with a lid that can be used as a drip tray, and a large drawer for vegetable and fruit storage. The cabinet dimensions are 35.7 in high by 22.4 in wide by 23.2 in deep and it is finished in either white or cream stoved enamel, with a pale blue interior. The price of the model A.350 is £37 3s 4d plus £6 18s 8d purchase tax.

ATLAS "A-PLAN" LIGHTING

WHAT is claimed to be the answer to many lighting problems for which conventional fluorescent fittings are not considered suitable, has been produced by **ATLAS LIGHTING, LTD.**, Thorn House, Upper St. Martin's Lane, London, W.C.2, with the introduction of their new "A-Plan" series of fluorescent fittings. The "A-Plan" fittings, suitable for domestic as well as display purposes, are both decorative and inexpensive, yet simple to install. They are extremely versatile and can be used for pelmet, bookcase, picture, or alcove lighting and certain of the fittings are particularly suitable for the illumination of mirrors, dressing tables, writing desks, etc. To complete the system, an attractive fabric covered fitting has been designed for use as a bedhead light. Other applications can be found in corridor, room and foyer lighting for hotels, reception areas in office buildings, showrooms and stores.

Altogether there are six basic types of "A-Plan" fittings. Type LFS, which is available in either 4ft 40 W or 5ft 80 W sizes, has a sparkling slotted metal reflector with wooden end panels and is designed to fit directly to the ceiling, giving downward light. The 4ft size (price £6 7s 4d) is in a choice of four colours—white, black, tangerine and mushroom, and the 5ft

size (£7 12s 2d) is available in white, black or mushroom. The LES series, available in 2ft 20 W, 4ft 40 W and 5ft 80 W sizes, has a slim metal reflector with wooden end panels, throwing light upwards and downwards, and is designed specifically for wall mounting. The 2ft version (£5 8s) is available in either white or mushroom, the 4ft fitting (£7 1s 6d) is available in either white, tangerine or mushroom, and the 5ft (£8 5s 2d) in either white or mushroom.

The LDS series, also intended for wall mounting, has a slotted metal trough reflector giving downward light only. The 2ft version (£5 8s) is available in either white or tangerine, the 4ft (£7 1s 6d) in white, black, tangerine or mushroom, and the 5ft (£8 5s 2d) in white, mushroom or black. Both the LES and LDS fittings are especially suitable for picture, pelmet and bookcase lighting, etc.

The HDK/KN fitting is a wall mounted fitting with a shielded plastic diffuser giving downward and horizontal light, and is available in 2ft and 4ft sizes, priced at £3 18s 4d and £5 6s 4d respectively. A pull switch assembly for use with this fitting can be purchased as an optional extra, price 8s.

The HDK/KW fitting for ceiling mounting has a decorative clip-on



Two of the Atlas "A-Plan" fluorescent lighting fittings—the LDS series 5ft fitting in use for pelmet lighting and an HDK/KN 2ft fitting shown over a writing table

diffuser in extruded plastic with blue end panels, and is obtainable in 2ft, 4ft and 5ft sizes, priced at £4 11s 4d, £6 5s 4d and £7 10s 6d respectively. This fitting is suitable for a variety of general lighting applications.

The HDK/LA12 is a 2ft bedhead fitting with an attractive patterned fabric diffuser with wooden end pieces, price £6 8s 2d. All prices are for the complete fittings and include purchase tax.

Specify "Erskine Heap"

FOR UTMOST RELIABILITY
with minimum maintenance costs

Here you will see three examples of the range of SWITCHGEAR and MOTOR CONTROL GEAR that we cover. In the top illustration is a 3000 H.P. KOHNDORFFER type Auto-Transformer Starter.

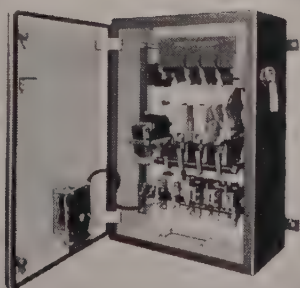
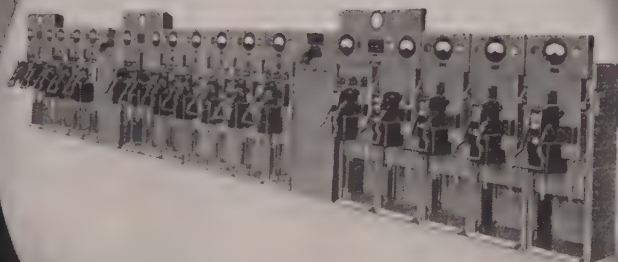
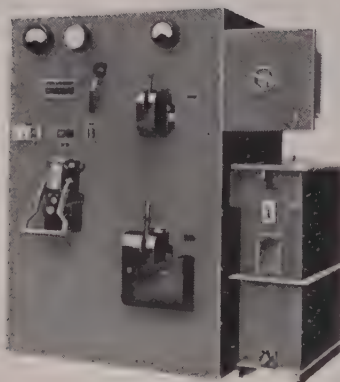
The middle illustration shows 400 Volt Vertical Isolator Switchboard containing CIRCUTT BREAKERS ASTA certified in 25 MVA in 400 Volts to BS5. 116.

Below is one of our contactor type direct-on STARTERS. All our Starters and Switchgear are fitted with magnetic type solenoid overload.

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L. T. SWITCHGEAR from
50/7,000 Amps

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BATTERY SPACE REDUCED BY HALF

WITH THE NEW TUDOR HIGH PERFORMANCE STATIONARY CELL

Savings of up to 50% in the space required for a stationary battery are made with the introduction of a new Tudor cell. A high performance sealed cell with Planté positive plates and pasted grid negative plates, separated by ribbed diaphragms of microporous Porvic, it is specially designed for trickle-charge operation. It is therefore the ideal cell for all stand-by applications, including emergency lighting in hospitals, cinemas, theatres and public buildings of all kinds, and auxiliary duties in both nuclear and conventional power stations. The design of the cell results in a lower internal resistance and therefore provides a very much improved high rate performance, making it eminently suitable for switch-operating duties where high rates of discharge are involved.

With the great reduction of space required, and the renowned reliability and long life of its predecessors, this new Tudor high performance cell marks a great step forward in stationary battery design.



THE IMPROVED SAFETYLYTE EMERGENCY LIGHTING EQUIPMENT

Tudor Safetylyte equipments are now being fitted with the new stationary cell. Charge and control cubicles are of improved design—the larger equipments being of folded sheet steel, and the smaller specially constructed for wall-mounting, employing automatic mercury relay in place of a contactor.



THE NEW SWITCH-TRIPPING EQUIPMENT

Tudor switch-tripping units will in future be fitted with the new cell. The cubicles have also been redesigned, and are available in folded sheet steel or wooden cabinet construction. The charger can now be used for both trickle and quick charging.

Tudor TUDOR BATTERIES

T 173A

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

THE problem of rapid reclosing for systems at 220 kV and higher voltages, where the phenomena on the occurrence of faults are more complicated than in medium-voltage systems, is discussed. The article considers first the types of faults which are possible at v.h.v., distinguishing between conditions in systems with and without neutral earthing. Furthermore, the two cases of single-phase and three-phase reclosing are considered separately, enabling the special cases in which one or the other type of reclosing is indicated to be dealt with in detail. The fundamental questions are those of the longest permissible duration of the fault without upsetting the stability, and the time required for the extinction of the residual arc and dielectric strength recovery.

The stability of interconnected systems is much greater than that of non-interconnected systems, whether the reclosing is single- or three-phase. Systems without many interconnections, or with no interconnections, show much better stability after single-phase than after three-phase reclosing. The test results represented are taken from Sweden, Switzerland, Germany, France, Canada, U.S.A. and U.S.S.R. and indicate that in general 0.2 sec is sufficient for arc extinction and de-ionisation (this applies to voltages up to 400 kV). Auxiliary methods can be used where special reasons exist for not adopting normal reclosing, by the use of short-circuiters for the faulted phase or connecting it to earth by water jets. In the relatively short Swiss lines no residual arcs occur. Some examples of the protective equipment used in various countries for rapid reclosing are shown and discussed.—“Rapid Reclosing in V.H.V. Transmissions,” by P. Baltensperger, *Bull. Assoc. Suisse Elect.*, Vol. 51, No. 21, pp. 1106-1113, 22nd October, 1960, in German.

Selenium Rectifier Ageing

The ageing of selenium rectifier cells whose rectifying effect was increased by an artificial barrier layer is considered. One method of producing such an artificial barrier is the immersion of the selenium discs in a weak alcoholic or acetone solution of potassium permanganate. The comparatively rapid ageing of such selenium discs must be due to structural changes in the selenium layer, which were actually found to be caused by the diffusion of chemically active particles from the artificial barrier layer into the selenium. These particles form chemical bonds with the refining additions in the selenium which result in the ageing phenomena observed.

The ageing mechanism is considered theoretically by the diffusion laws in the way suggested by Frank and Sitte (unidirectional diffusion). An example is calculated which demonstrates that if the diffusion factor and the

relationship between differential resistance and thickness of the barrier layer are known (assuming this refers to the actual, and not an “equivalent” thickness), it will be possible to predict the further progress of ageing of selenium cells from a short series of observations. Since the artificial barrier layers have thicknesses of 30 to 80 μ , the calculated increase rates of these thicknesses are very likely to be of the correct order of magnitude, the same applying to the diffusion factor assumed. The author discusses some probable objections to the method of theoretical treatment, but can prove that even this idealised method yields practically useful results.—“Ageing of Selenium Rectifiers with an Artificial Barrier Layer,” by J. Krocze, *Elektrotech. Obzor*, Vol. 49, No. 10, pp. 516-520, October, 1960, in Czech.

Earth Leakage Protection

The different protective methods used in l.v. distribution systems and on service installations are dealt with, particularly the earth-leakage protection switches operated by fault current and voltage which are compared. The modern types of these switches are considered and their correct wiring is described. The fault-current-operated switch has the advantage of far greater independence of the earth resistances than the protective earthing method, this advantage being even more marked for fault-voltage switches. It is stressed that the protective effect of these switches depends essentially on the judicious choice of the current setting (preferably <15 mA) and on the response, or total breaking time. Special types of fault-current switches are those with differential release and with an integrating current transformer. The use of fault-current switches in systems with “Nullung” is considered, where there are special requirements to be satisfied by these switches. Also, a special circuit with an additional neutral-voltage supervision for locations with high earthing resistances and dangers of neutral breakage is described. — “Earth-Leakage Protection Switches Operated by Fault Current,” by G. Biegelmeier and E. Maier, *Bull. Assoc. Suisse Elect.*, Vol. 51, No. 23, pp. 1197-1201, 19th November, 1960, in German.

Lamp Caps and Holders

THE British Standard B.S. 495 “Lamp Caps and Lamp-holders for Double-Capped Tubular Lamps” is a revised version of the publication issued in 1933, and since amended, under the title: “Fittings for Double-Capped Tubular Lamps.” The revised standard specifies in greater detail the requirements for lamp caps and lampholders for double-capped tubular lamps for voltages not exceeding 250 V. Requirements for a combined pair of lampholders embodied in a fitting suitable for double-capped tubular lamps have been included. Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 3s.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 15th February from the Patent Office, 25, Southampton Buildings, London, W.C.2

1956

713. Hivac, Ltd.—Gas filled electric discharge tubes. 4th April, 1957. (861116.)
 9150. Standard Telephones & Cables, Ltd.—Electric switching circuits. 22nd March, 1957. (861124.)
 14954. National Research Development Corporation.—Electrical measuring instruments. 9th August, 1957. (860917.)
 25098. Associated Electrical Industries, Ltd.—Thyratrons. 16th August, 1957. (860867.)
 30590. Imperial Chemical Industries, Ltd.—Electric heating device. 2nd October, 1957. (861193.)
 37916. Ferranti, Ltd.—A.c. measuring apparatus. 9th December, 1957. (860681.)

1957

6081. General Electric Co., Ltd.—Sodium vapour electric discharge lamps. 24th February, 1958. (861122.)
 6526. Du Pont de Nemours & Co., E. I.—Covered electrical conductor. 27th February, 1957. (861300.)
 15484. Texas Instruments, Inc.—Electric terminal construction. 15th May, 1957. (861094.)
 16092. Fabrik van Electrische Apparaten N.V.—Small oil volume high voltage circuit-breaker of the column type. 21st May, 1957. (860891.)
 17033. Fernseh G.m.b.H.—Apparatus for generating electrical pulse signals. 29th May, 1957. (861123.)
 18185. Licentia Patent-Verwaltungs-G.m.b.H.—Electrically asymmetrically conductive systems with at least one p-n junction and method of producing such systems. 7th June, 1957. (861196.)
 19984. Philips Electrical Industries, Ltd.—Electric switches. 25th June, 1957. (860873.)
 20040. Siemens-Schuckertwerke A.G.—Electrically heated apparatus for the production of semiconductor material. 25th June, 1957. (861135.)
 21011. English Electric Co., Ltd.—Dynamo-electric machines. 27th June, 1958. (860931.)
 23601. Philips Electrical Industries, Ltd.—Electric glow discharge indicator tubes. 25th July, 1957. (861137.)
 26496. National Research Development Corporation.—Electrical digital computing engines. 15th August, 1958. (861190.)
 31883. Compagnie des Lampes.—Bi-pin electric lampholders or sockets. 11th October, 1957. (861198.)
 32001. International Business Machines Corporation.—Electrically superconductive circuit elements. 14th October, 1957. (861280.)
 33238. Compagnie Industrielle des Telephones.—Electronic switching devices. 24th October, 1957. (861139.)
 37149. Siemens & Halske A.G.—Systems for establishing electrical connections. 28th November, 1957. (861152.)
 38553. General Electric Co., Ltd.—Electric circuit arrangements for starting and operating one or more electric discharge lamps. 11th December, 1958. (861179.)
- ### 1958
6183. General Electric Co., Ltd.—Electric circuit arrangements for starting and operating electric discharge lamps having heatable electrodes. 25th February, 1959. (861181.)
 6575. Reyrolle & Co., Ltd., A.—Live-line indication for h.v. switchgear. 28th February, 1958. (861154.)

10142. Accumulatoren-Fabrik A.G.—Electrolytic counter cell. 28th March, 1958. (861159.)
 10432. General Electric Co., Ltd.—Radiation screens for electric furnaces. 16th March, 1959. (861257.)
 10433. Heating element assemblies for electric furnaces. 16th March, 1959. (861258.)
 15857. Associated Electrical Industries, Ltd.—Rotary switch operating mechanism. 14th May, 1959. (861209.)
 19598. Chamberlain & Hookham, Ltd., Lewis, H. S., and McGuirk, F.—Synchronous electric motors. 19th June, 1959. (860941.)
 19736. United Kingdom Atomic Energy Authority.—Nuclear fusion reactor. 16th June, 1959. (861185.)
 22503/4. A.E.I.—John Thompson Nuclear Energy Co., Ltd.—Fuel elements for nuclear reactors. 10th July, 1959. (861222 and 861329.)
 25718. International Business Machines Corporation.—Apparatus for supplying rectified current from an a.c. supply source. 11th August, 1958. (861261.)
 25861. Telephone Manufacturing Co., Ltd.—Electrical switches. 6th August, 1959. (860943.)
 29514. Sunbeam Corporation.—Electric pressing iron having thermostatic control. 15th September, 1958. (860945.)
 30834. Marconi's Wireless Telegraph Co., Ltd.—Transistor gating circuit arrangements. 1st June, 1959. (861263.)
 31023. Telefunken G.m.b.H.—Stepping electric motors. 29th September, 1958. (861308.)
 31050. Patent-Treuhand-Gesellschaft für

- Elektrische Glühlampen.—Electrically heated tank furnace for the melting of quartz. 11th September, 1959. (860740.)
 35915. Odenwald, A.—Thermal electric switches. 8th November, 1958. (861313.)
 38771. Sealectro Corporation.—Hermetically sealed lead-through electric terminal. 2nd December, 1958. (861264.)
 39132. Blanchet, L.—Electrical terminal assemblies. 4th December, 1958. (861239.)
 39557. Sylvania Electric Products, Inc.—Electric incandescent lamps. 8th December, 1958. (861032.)

1959

649. Philips Electrical Industries, Ltd.—Spring blade assemblies for electric contacts. 7th January, 1959. (861149.)
 10224. Ellenberger & Poensgen G.m.b.H.—Thermally operated circuit-breaker. 24th March, 1959. (860861.)
 10407. Zavody V. I. Lenina Plzen, Narodni Podnik.—Commutator assembly for electric machines. 25th March, 1959. (861269.)
 23959. Canadian Westinghouse Co., Ltd.—Electric motor control systems. 13th July, 1959. (861203.)
 24456. National Cash Register Co.—Electrical switch. 16th July, 1959. (861204.)
 40726. Allmänna Svenska Elektriska A.B.—Electric vacuum melting furnace. 1st December, 1959. (861276.)

1960

36216. Standard Telephones & Cables, Ltd.—Electric switching circuits. 22nd March, 1957. (861125.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 25th February:—

Protocoat. No. B807,422. Class 2. Anticorrosives for use by spraying.—British Insulated Callender's Cables, Ltd., Norfolk House, Norfolk Street, London, W.C.2.

Design (magnet and globe). No. 799,745. Class 7. Electric motors and steam, gas and water turbines; generators; welding machines; lifts and hoists; cranes; escalators, etc. No. 799,747. Class 11. Lamps and lighting fittings; electric furnaces; cooking stoves; toasters; refrigerating and freezing apparatus; ventilating apparatus; nuclear energy installations, reactors and installations for processing nuclear fuel, etc.—Allmänna Svenska Elektriska Aktiebolaget, Västerås, Sweden. Address for service: J. Y. & G. W. Johnson, 47, Lincoln's Inn Fields, London, W.C.2.

McClary-Easy. No. B805,003. Class 7. Machines for washing and drying.—General Steel Wares, Ltd., Toronto, Canada. Address for service: Raworth, Moss & Cook, 38, Sydenham Road, Croydon, Surrey.

Ever Ready. No. 806,143. Class 7. Electric domestic washing machines and spin dryers.—Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7.

EMI. No. B809,579. Class 7. Electric drying, washing and ironing machines. No. B809,581. Class 9. Electric scientific instruments; recording and reproducing apparatus; electron discharge devices; vacuum cleaning apparatus; flat irons; kitchen utensils, etc. No. B809,583. Refrigerating machines and installations, and lighting, heating, cooking and drying apparatus (not fans).—Electric & Musical Industries, Ltd., Blyth Road, Hayes, Middx.

Safari. No. 812,022. Class 8. Electric shavers.—Kent Kordless, Ltd., 106, Edmund Street, Birmingham.

Transtar. No. 797,869. Class 9. Electrical apparatus and instruments.—Inductive Appliances, Ltd., 4, St. Nicholas Buildings, St. Nicholas Street, Newcastle-upon-Tyne.

FAEMA (design). No. 802,272. Also without design (No. 802,277). Class 9. Vacuum cleaners, etc.—Ernesto Valente, Milan, Italy. Address for service: Wilson, Gunn & Ellis, 57, Market Street, Manchester.

Optimat. No. 809,213. Class 9. Alarm, calculating, control, indicating, signalling and testing apparatus.—Panellit, Ltd., 70, Dudden Hill Lane, London, N.W.10.


Philips (on shield). No. 796,504. All goods included in Class 10.—Philips Electrical, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Alux. No. 777,403. Class 11. Electric lamps and lighting installations.—Veritys, Ltd., Hazelwell Works, Fordhouse Lane, Sturcheley, Birmingham, and Westdeutsche Beleuchtungs-Ges. Schellenbach K.-G., Düsseldorf, Germany.

Indess. No. 799,286. Class 11. Refrigerators and air-conditioning apparatus (not machines).—Indes Ind. Elettrodomestici S.p.A., Turin, Italy. Address for service: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

Creda Rosta-Spit. No. 801,256. Class 11. Rotating spit roasters.—Simplex Electric Co., Ltd., Creda Works, Grindley Lane, Blythe Bridge, Stoke-on-Trent.

Cresta. No. B802,504. Class 11. Electric lamps.—Ascot Lamps & Lighting, Ltd., Arcola Street, London, E.8.



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faster...
at lower unit cost**

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GLASS FIBRE REINFORCED PLASTICS

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— and another 'MICRO-sen'

THIS time in conjunction with E.M.B. Equipment it is used to control the haulage mechanism supplied by Mitchell Engineering Ltd., of Peterborough, for placing wagons on to the tippler at Denbeath Central Coal Washery N.C.B.

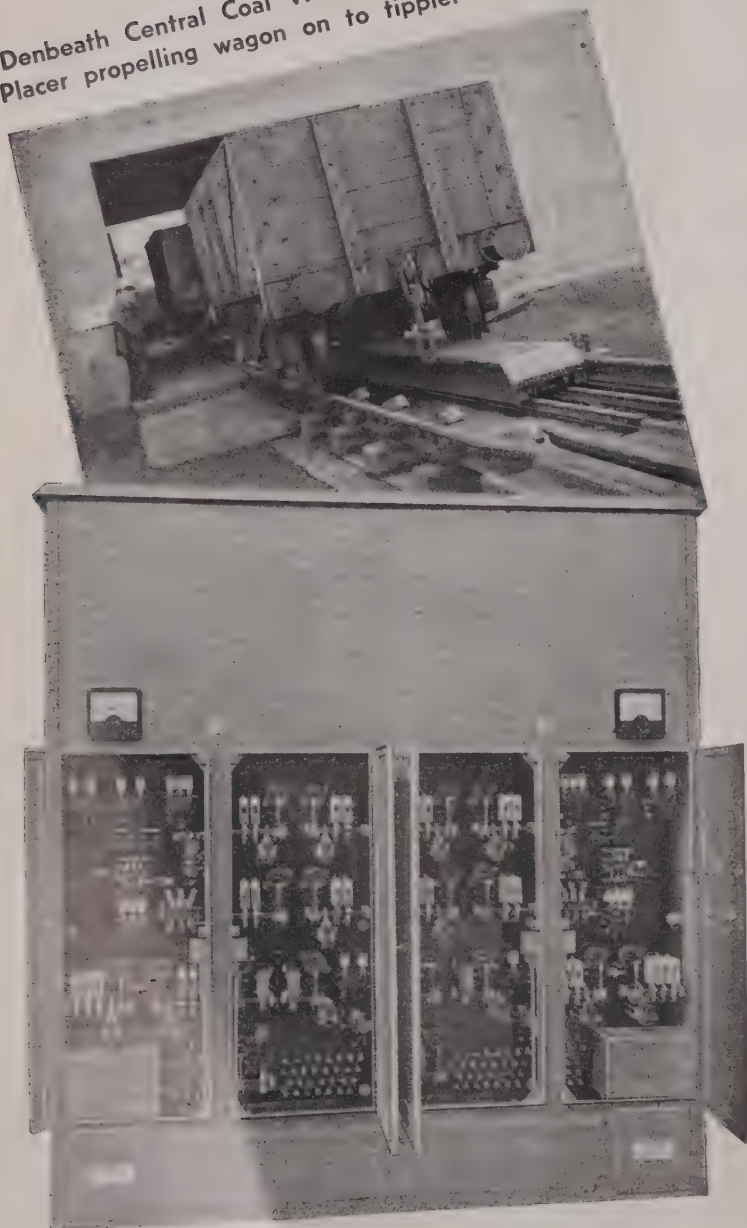
We understand that the whole equipment is working very satisfactorily and has become a showpiece for engineers from other areas.

The 'MICRO-sen' gives an accurate speed control for any standard A.C. slip-ring motor.

Speeds can be obtained ranging from 10% to full synchronous speed.

Other 'MICRO-sen' applications include nuclear power station cranes, skip hoists, coke oven plants, guided missile and rocket installations.

Denbeath Central Coal Washery NCB
Placer propelling wagon on to tippler



With acknowledgements to—
MITCHELL ENGINEERING LTD
THE DAYLITE ELECTRICAL Co LTD
THE NATIONAL COAL BOARD

E.M.B. Co Ltd

WEST BROMWICH
ENGLAND

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 6th FEBRUARY

Birmingham.—James Watt Memorial Institute, 6.30 p.m. I.E.E. South Midland Centre. "Development of H.V. Air-Break Circuit-Breakers with Insulated-Steel-Plate Arc Chutes," by F. S. Fay, J. A. Thomas, D. Legg and J. S. Morton.

Bolton.—Railway Hotel, Trinity Street, 7.45 p.m. A.S.E.E. Bolton Branch. "Control Instruments."

Ilford Broadway.—Angel Hotel, Broadway, 8.15 p.m. A.S.E.E. Essex Branch. "Automatic Control," by Dr. W. L. Stern.

Leeds.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Instrument Aids in Obtaining Higher Boiler Efficiency," by J. W. Nixon.

Liverpool.—Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "The Logical Design of Electrical Networks using Linear Programming Methods," by U. G. W. Knight.

Liverpool Engineering Society. The Temple, Dale Street, 6 p.m. Institute of Marine Engineers, Merseyside and North Western Section. Annual general meeting followed by "Details and Operating Data of Recent A.C. Installations," by A. N. Savage.

London.—Geological Society, Burlington House, W, 5 p.m. Society of Engineers. Presidential address by W. E. Humphrey and presentation of premiums awarded in 1960.

Maidstone.—Technical College, 7 p.m. I.E.E. Maidstone Branch. "Road Heating," by L. H. Carmalt.

Malvern.—Winter Gardens, 7.30 p.m. I.E.E. Malvern and District Group. "Cosmic Thunderstorms," by Dr. C. E. R. Bruce.

Newcastle-upon-Tyne.—County Hotel, Neville Street, 6.30 p.m. North East Electrical Club. "Highways of the Air," by Captain O. P. Jones.

Sheffield.—University, St. George's Square, 7 p.m. Society of Instrument Technology, South Yorkshire Section. "Some Aspects of Instrumentation in Steelworks," by Dr. R. H. Bauk.

Royal Victoria Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. Films and slides "A Tour Round Britain," by F. E. Price.

TUESDAY, 7th FEBRUARY

Burton-on-Trent.—E.M.E.B., Church Croft, Horninglow Street, 6.30 p.m. I.E.E. East Midland Centre. "Research on the Performance of High-Voltage Insulators in Polluted Atmospheres," by Dr. J. S. Forrest, P. J. Lambeth and D. F. Oakshott.

Edinburgh.—Carlton Hotel, 7 p.m. I.E.E. South East Scotland Sub-Centre. "A Visit to South Africa," by Professor M. G. Say.

Huddersfield.—George Hotel, 2.30 p.m. Combustion Engineering Association, Northern Region. "Planned Plant Maintenance."

Leeds.—Leeds and County Conservative Club, South Parade, 6.30 p.m. I.E.E. North Midland Centre. "The Application of Electronics to the Electricity Supply Industry," by Dr. J. S. Forrest.

Leicester.—Westcotes Constitutional Club, Wilberforce Road, 7.30 p.m. A.S.E.E. Leicester Branch. "Control Centres for Modern Industry," by H. B. Davies.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Electronics Sections. "Magnetic Properties of Thin Films for Computing Devices," by E. M. Bradley.

Windsor Castle Hotel, 134, King Street, Hammersmith, W.6, 7.45 p.m. A.S.E.E. West London Branch. Films.

Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 7 p.m. Institution of Plant Engineers. "Standards in Plant Engineering," by Dr. E. L. Diamond.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western

Utilisation Group. "A Survey of Street Lighting and its Future," by W. R. Stevens and H. M. Ferguson.

Norwich.—Assembly House, 7.30 p.m. I.E.E. East Anglian Sub-Centre and Institution of Mechanical Engineers, East Midland Branch. "The Deltic Locomotive," by C. M. Cock.

Reading.—Marquis of Lorne, Friar Street, 7.30 p.m. A.S.E.E. Reading and Districts Branch. "Refrigeration."

Southampton.—University, 6.30 p.m. I.E.E. Southern Centre. "Stereophonic Transmission and Reproduction," by P. M. Thompson.

WEDNESDAY, 8th FEBRUARY

Birmingham.—James Watt Memorial Institute, 6.30 p.m. I.E.E. South Midland Graduate and Student Section. "Electro-Physiology," by D. Lane.

Exchange and Engineering Centre, Stephenson Place, 7.30 p.m. A.S.E.E. Birmingham Branch. "Panelc Floor Warming and Ancillary Equipment," by K. W. Ballamy.

Brighton.—Gas Showrooms, Church Street, 7.30 p.m. Ministry of Works. "Artificial Lighting for Modern Buildings," by J. B. Harris.

Cardiff.—Welsh College of Advanced Technology, 6.30 p.m. British Institution of Radio Engineers, South Wales Section. "The Principles of Analogue to Digital Computer Conversion," by J. L. W. Churchill.

Dundee.—Royal Hotel, Union Street. Combustion Engineering Association, Scotland Branch, 10 a.m. Discussion on "Scheduled Maintenance of Boiler Plant and Auxiliaries," opened by L. M. Kenneth. 2 p.m. "Performance and Cost Control," opened by C. W. Scott.

Glasgow.—39, Elmbank Crescent, 6 p.m. I.E.E. South West Scotland Sub-Centre. "Energy Resources of Scotland," by J. Henderson and C. L. C. Allan.

Lancaster.—N.W.E.B. Demonstration Theatre, Lancaster Road, 7.30 p.m. I.E.E. North Lancashire Sub-Centre. "A Survey of Street Lighting and its Future," by W. R. Stevens and H. M. Ferguson.

London.—London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 5.30 p.m. British Institution of Radio Engineers, Computer Group. "Perseus, a Medium-scale Data Processing System," by G. Emery.

Café Royal, 7 for 7.30 p.m. I.E.E. Electronics and Measurement Sections. Joint dinner-dance.

Luton.—Luton College of Technology, Park Square, 8.15 p.m. A.S.E.E. Luton Branch. "Variable Speed A.C. Motors," by J. C. Bone.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Electronics and Communication Group. "Microminiaturisation," by L. J. Ward.

Newport.—King's Head Hotel, 6.30 p.m. Newport and District Electric Club. "Architecture and the Electrical Engineer," by Alex J. Gordon.

Northampton.—Room B16, College of Technology, 7.15 p.m. Northampton and District Electrical Association. "The Future Development of the Telephone," by W. R. J. Lowe.

Oxford.—37, George Street, 7 p.m. I.E.E. Oxford Branch. "Development of Eurovision," by M. J. Pulling.

THURSDAY, 9th FEBRUARY

Bradford.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford and District Branch. "Further Developments in Metal Rectifiers," by D. Magnall.

Cambridge.—Cavendish Laboratory, 8 p.m. I.E.E. Cambridge Electronics and Measure-

ment Group. "The Ultrasonic Microscope," by C. N. Smyth.

Cheltenham.—Belle Vue Hotel, 7.30 p.m. Society of Instrument Technology, Cheltenham Section. "Instrumentation at Berkeley Power Station," by F. J. Benstead.

Dundee.—Electrical Engineering Department, Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. "Subscriber Trunk Dialling," by D. A. Barron (to be read by H. E. Francis).

Harwell.—Reactor School, A.E.R.E., 5.45 p.m. A.S.E.E. Oxford and Districts Branch. "Electric Motor Control Gear," by R. F. Mathieson.

Liverpool.—Hanbury Restaurant, Fenwick Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. Annual hot-pot supper and entertainment.

London.—Savoy Hill, W.C.2, 5.30 p.m. I.E.E. Utilisation Section. "Some Notes on the Electrical Requirements of General Cargo Docks," by E. R. Radway.

Prince of Wales Hotel, S.W.19, 7.45 p.m. A.S.E.E. South West London Branch. "Progress in Sound Recording," by G. M. Nathan.

Manchester.—North Western Electricity Board, Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "Floodlighting of Liverpool Cathedral," by C. C. Smith.

Poole.—C.E.G.B. Generating Station, 6.30 p.m. I.E.E. Southern Graduate and Student Section. "F.M. Reception," by A. C. Davies.

Swansea.—S.W.E.B., The Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "Discrimination Between H.R.C. Fuses," by E. Jacks.

FRIDAY, 10th FEBRUARY

Aberdeen.—Robert Gordon's Technical College, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "Subscriber Trunk Dialling," by D. A. Barron (to be read by H. E. Francis).

Birmingham.—New Billesley Hotel, Kings Heath. A.S.E.E. Branch annual dinner-dance.

Cambridge.—Dorothy Restaurant, 7 for 7.30 p.m. I.E.E. East Anglian Sub-Centre. Annual dinner-dance.

Colchester.—Davey, Paxman & Co., Ltd., 7.30 p.m. Institution of Production Engineers, Eastern Region. "Further Training of University Graduates with Particular Reference to Production Engineering," by S. H. Potter.

Goucester.—Wheatstone Hall, Brunswick Road, 7.30 p.m. Institution of Production Engineers, South Western Region. "Materials Problems in Nuclear Energy," by Dr. P. Murray.

Liverpool.—Exchange Hotel, Tithebarn Street, 6.45 for 7.30 p.m. Electrical Contractors' Association, Liverpool Branch. Annual dinner.

London.—14, Rochester Row, Westminster, S.W.1, 7 p.m. Junior Institution of Engineers. "The Measurement of Nuclear Radiation," by G. G. Ballard.

Caxton Hall, Westminster, 6.30 p.m. Electrical Power Engineers' Association. "Some Second Thoughts," by L. B. S. Golds.

Newcastle-upon-Tyne.—King's College, 6.30 p.m. I.E.E. North Eastern Graduate and Student Section. "Performance and Design of Artificial Transmission Line with Distributed Parameters," by J. P. Patel.

Newport (I.O.W.).—S.E.B. Showrooms, 6.30 p.m. I.E.E. Southern Centre. "Thermo-Nuclear Physics," by Dr. T. E. Allibone.

Stoke-on-Trent.—North Staffs. College of Technology, 6.30 for 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Planning and Installation of the Sound Broadcasting Headquarters for the B.B.C.'s Overseas and European Services," by F. Axon and O. H. Barron.

Taunton.—Empire Ballroom, County Hotel. E.I.B.A. Taunton Branch. Dinner-dance.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Bridge-Blean.—R.D.C. 8th March. Pumping plant for Chislet sewerage scheme. Engineer and surveyor, Council Offices, 41, Old Dover Road, Canterbury.

Broadstairs.—U.D.C. 11th February. Supply of coloured electric lamps for the year ending 31st March, 1962. Engineer and surveyor, Pierremont Hall.

Cardiff.—City Council. 20th February. Street lighting stores and equipment for the year ending 31st March, 1962. City surveyor, City Hall.

Croydon.—Town Council. 17th February. Electrical work in 720 pre-war houses. Mitcham estate. (See this issue.)

Ilminster.—U.D.C. 21st February. Trunk road lighting. (See this issue.)

India.—India Stores Department, London. 6th March. Four 25 kVA diesel alternators with switchgear. (See this issue.)

Madras State Electricity Board. 13th March. 230 and 110 kV transmission line towers. (E.S.B. 925/61.)*

Director General of Supplies and Disposals, New Delhi. 24th February. Twin p.v.c. cable for telephone wiring. (E.S.B. 924/61.)*

India Supply Mission, Washington, D.C. 28th February. Carrier communication equipment. (See this issue.)

Italy.—N.A.T.O. Infrastructure Contracts. Six power supply units for telephone switchboard (Contract 9947). Armoured lead covered cable (Contract 9946). Applications to tender by 10th February. (G.D. 1472/60/81.)* Four multitone assemblies (Contract 9954) and four operation interphones (Contract 9955). Applications to tender by 18th February. Cable laying between six airfields (Contracts 9948-53). Applications to tender by 22nd February. (G.D. 84/61(83-85).)*

Kidderminster.—Borough Council. 13th February. Electrical work in 30 dwellings. Borough engineer, 110, Mill Street.

Maesteg.—U.D.C. 18th February. Electrical fittings (Form No. 22) for the year ending 31st March, 1962. Engineer and surveyor, Council Offices, Maesteg, Glam.

New Zealand.—Dunedin Electricity Department. 24th February. Bare copper and p.v.c. insulated cables. (E.S.B. 864/61.)* P.i. copper cable. (E.S.B. 865/61.)*

Wellington Electricity Department. 21st February. 65V V pillar-type link boxes. (E.S.B. 866/61.)*

North Shields.—Coquet Water Board. 28th February. Cables for Warkworth filtration works and pumping station. (See this issue.)

Northern Ireland.—Belfast Electricity Department. 3rd March. 33/6.6 kV transformers. (See this issue.)

14th February. Electrical installation in Royal Ulster Constabulary County Headquarters, Palace Row, Armagh. Ministry of Finance, Room 103, Law Courts Building, Belfast.

14th February. Electrical installation in Bellaghy New Primary School, Co. Londonderry. Corr & McCormick, 7, Ferryquay Street, Londonderry.

Nottingham.—City Council. 20th March. Pumping plant at Basford pumping station. General manager, Water Department, Castle Boulevard.

Pakistan.—Department of Supply and Development, Karachi. 22nd February. A.c. network analyser. (E.S.B. 955/61.)*

Director General of Posts and Telegraphs, Karachi. 28th February. Intercommunication sets. (E.S.B. 999/61.)*

Salvador.—Rio Lempa Hydro-Electric Commission. Construction and equipping of Guajoyo water power project. (E.S.B. 2555/61.)*

Sudan.—Stores Department, Sudan Railways. 6th March. Electric furnace. (E.S.B. 974/61.)*

Sunderland.—Corporation. 13th February. Electrical installations in 260 houses, Town End Farm estate. Borough architect, Grange House, Stockton Road.

United States.—Bureau of Reclamation, Denver. 16th February. Voltage regulating transformer. (E.S.B. 976/61.)* 21st February. Transformers. (E.S.B. 867/61.)* 23rd February. Auto-transformer and voltage regulating transformer. (E.S.B. 977/61.)* 28th February. Switchgear. (E.S.B. 832/61.)*

Widnes.—Borough Council. 16th February. Electrical equipment (Form 7), and electric lamps (Form 8), for the year ending 31st March, 1962. Borough engineer, Town Hall.

ORDERS PLACED

Darlington.—Education Committee. Electrical work in extensions to the Barnard Special School (£1,158).—C. Horne & Co.

Edmonton.—Housing and Building Committee. Electrical installation work, Snells Park redevelopment scheme, block "B" (£4,679).—Holmes & Larkinson.

Halesowen.—Corporation. Recommended. Street lighting equipment (£17,291).—Revo Electric Co.

Hartlepool.—Corporation. Electrical installations in 48 houses, Throston area (£1,841).—John Westmoreland & Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aberdeen.—Extensions and modernisation, Aberdeen Grammar School (£284,600); city architect, 11, Broad Street, Castlegate.

Basingstoke.—Scheme for new municipal offices, public hall, etc.; borough architect.

Bolton.—Shops, 16-18, Oxford Street, for the Leeds Permanent Building Society; secretary, Permanent House, The Headrow, Leeds.

Bridport.—Extensions to Café Royal; Lambert & Oliver, architects, 35, South Street, Bridport.

Boote.—Houses (94), Strand Road/Jersey Street; borough surveyor.

Bristol.—School of Chemistry, Woodland Road site, for the University of Bristol; Courtaulds Technical Services, Foleshill Road, Coventry.

Cardiff.—Cleansing depot, Trade Street (£105,315) and police station at Llanishen; city architect, 12, Park Place.

Carlisle.—Proposed motel near former

Kingstown aerodrome; Johnston & Wright, architects, 13, Castle Street, Carlisle.

St. Bede's R.C. Primary School; N. M. Phillips, architect, Grosvenor House, Warwick Square, Carlisle.

Chester.—Erection of Hoole Secondary Modern School; city engineer, 49, Northgate Street.

Coventry.—Walsgrave C.E. Primary School; city architect, Council House. Blocks of flats (£500,000); city architect.

Glasgow.—Hotel and shopping block (10-storey building), Jamaica Street/Clyde Street corner site, for Great Universal Stores, Ltd.; W. Underwood & Partners, architects, La Belle Place, Glasgow, C.3.

Factory, Cumbernauld estate; Thames Board Mills, Purfleet.

Grantham.—Factory, Dysart Road; Welland Manufacturing Co., Ltd., King Newton Street, Leicester.

Huddersfield.—County primary school, Reinwood; borough architect, High Street Buildings.

Northern Ireland.—Proposed new building for Tyrone C.C. (£145,000); secretary, County Council, Omagh, Co. Tyrone.

Ross and Cromarty.—Houses (36), Alness, Munlochy and Strathpeffer; R. Armour & Partners, quantity surveyors, 375, Union Street, Aberdeen.

Rugeley (Staffs.).—Comprehensive medical centre (£150,000); Birmingham Regional Hospital Board, 10, Augustus Road, Edgbaston, Birmingham, 15.

Southampton.—Flats and maisonnettes (34), Weston Farm estate; borough engineer, Civic Centre.

Southport.—Works extensions; Mullard Magnetic Components, Ltd., Balmoral Drive.

South Shields.—Houses (112), Simonside; borough engineer.

Stafford.—Houses (118), Highfields estate; borough engineer, Mount Street.

Stockport.—R.C. secondary school, Glenfield Road; Arthur Farebrother & Partners, architects, 99, Seymour Grove, Manchester, 16.

Stockton-on-Tees.—X-ray department, Stockton and Thornaby Hospital; chief architect, Newcastle Hospital Board, Benfield Road, Newcastle-on-Tyne.

Sunderland.—R.C. school, Redcar Road, Southwick; David Brown, architect, 10, Lambton Road, Jesmond, Newcastle-on-Tyne.

Swadlincote.—Flats (32), Midland Road; surveyor, Bank House, Midland Road.

Tamworth.—Houses (850), Comberford Road site (172 will have electric space heating); borough engineer, Municipal Offices, Tamworth, Staffs.

Thornbury.—Houses at Marshwell Crescent, Almondsbury (20) and Quarry estate, Alveston (32); Rainger, Rogers & Smithson, architects, Wellington Square, Cheltenham.

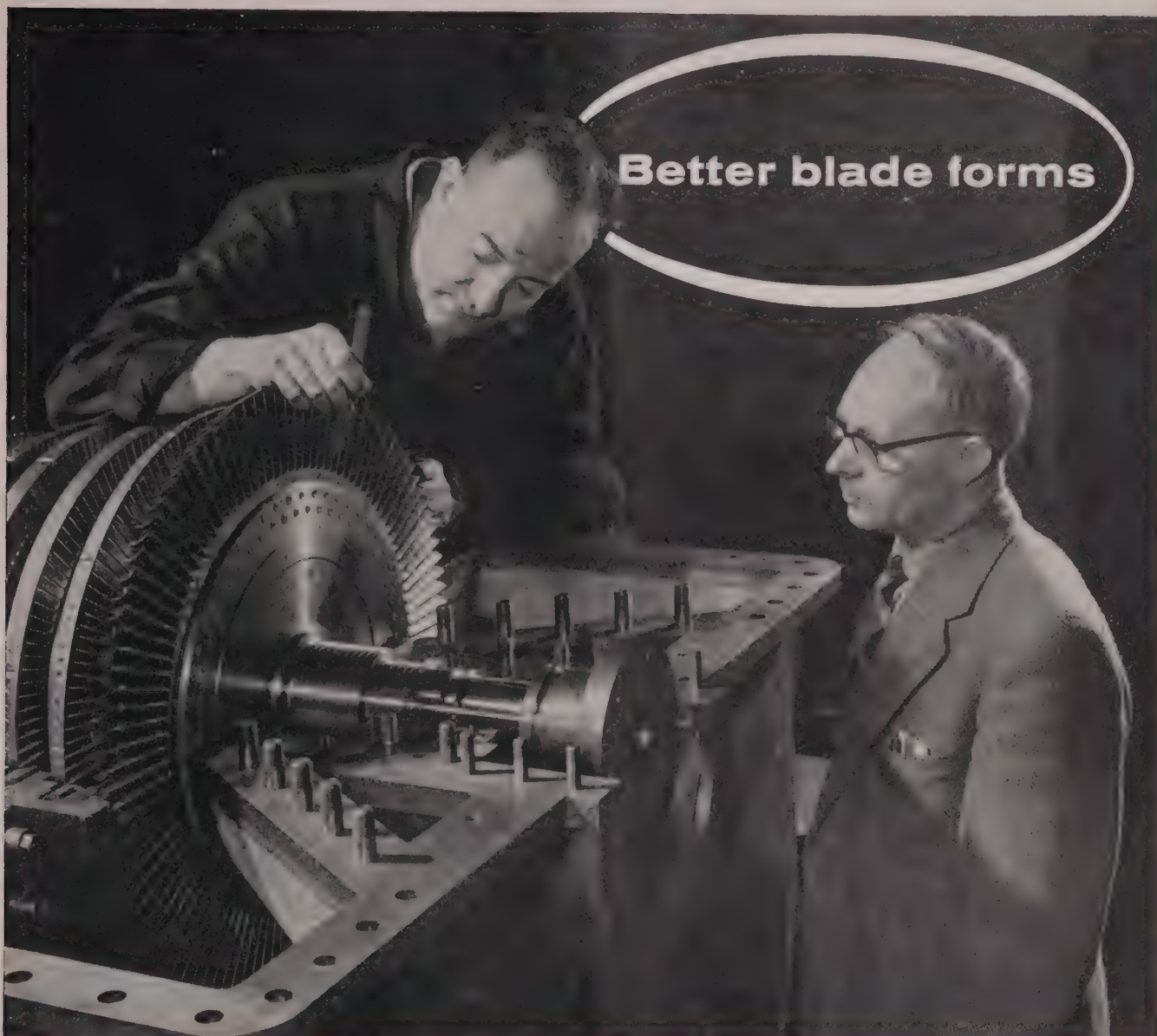
Walsall.—West Midlands Teachers' Training College; Richard Sheppard, Robson & Partners, architects, 5, Southampton Place, London, W.C.1.

Warlingham.—Methodist church, Limpsfield Road; P. W. Dawney & Carpenter, architects, 131, Victoria Street, London, S.W.1.

Whetstone.—New works and offices; Booth & Driver, Ltd., 16, Oakleigh Road North.

Wolverhampton.—Home and flatlets for old people, Broadway, Bushbury (£67,752); borough engineer, Town Hall.

* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given. †Telephone: Trafalgar 8855, Ext. 2010.

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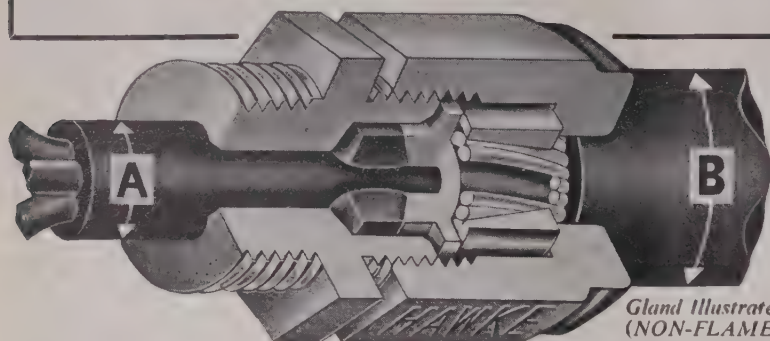


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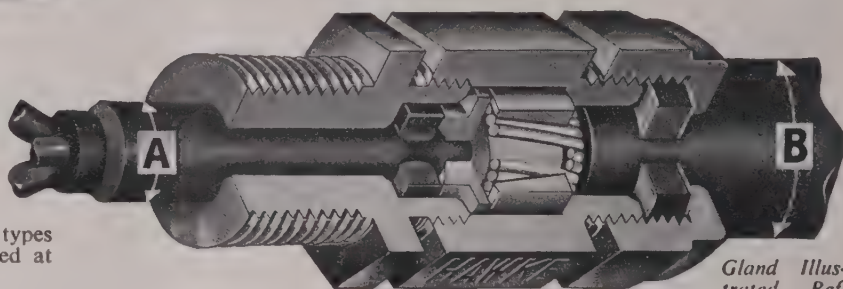
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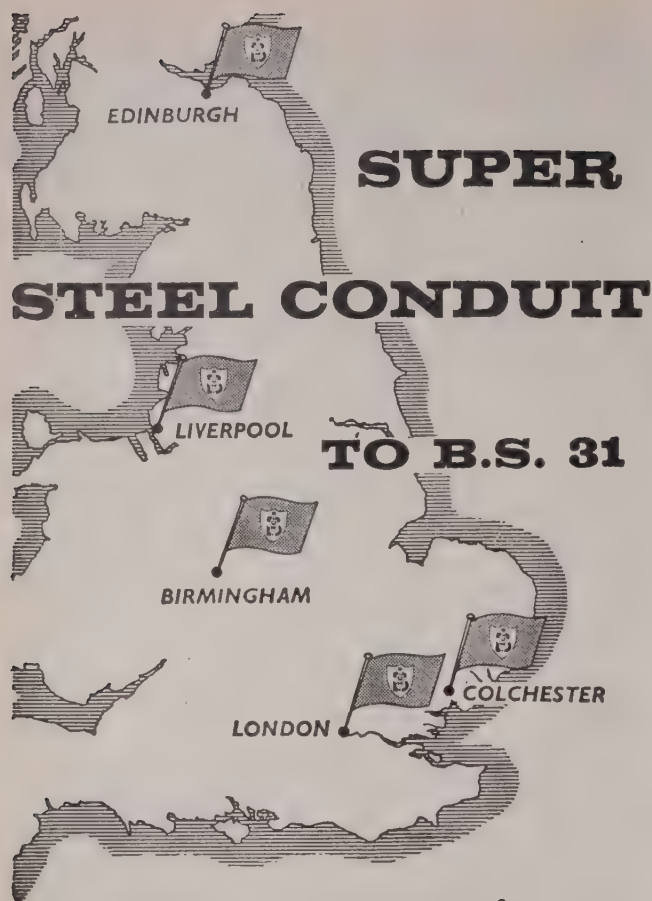
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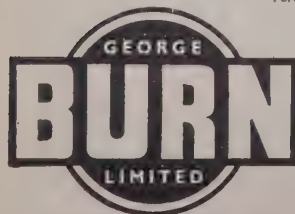
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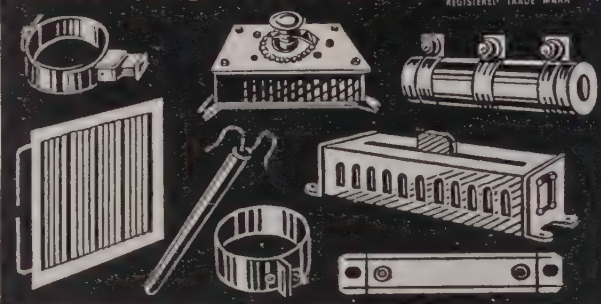
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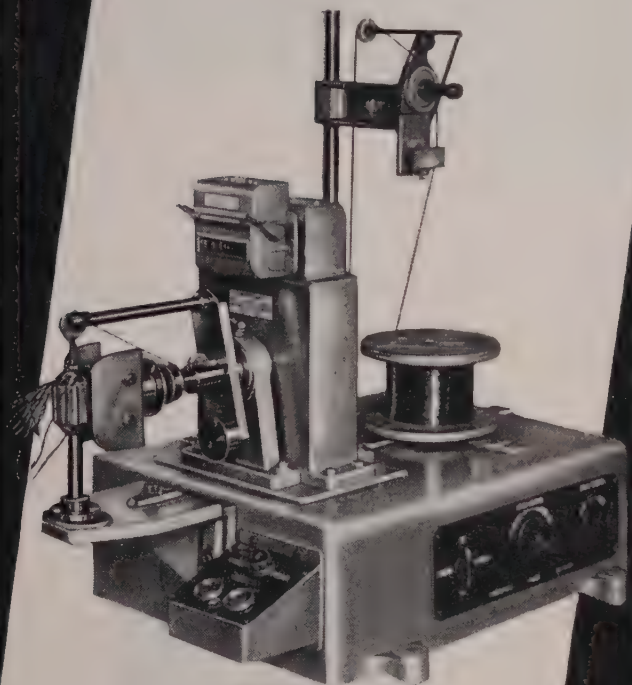
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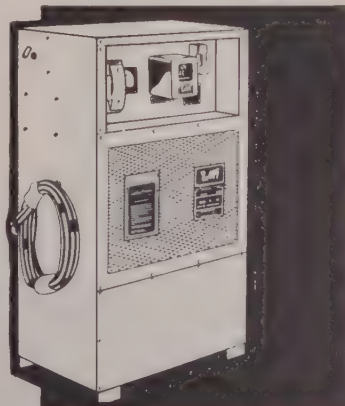
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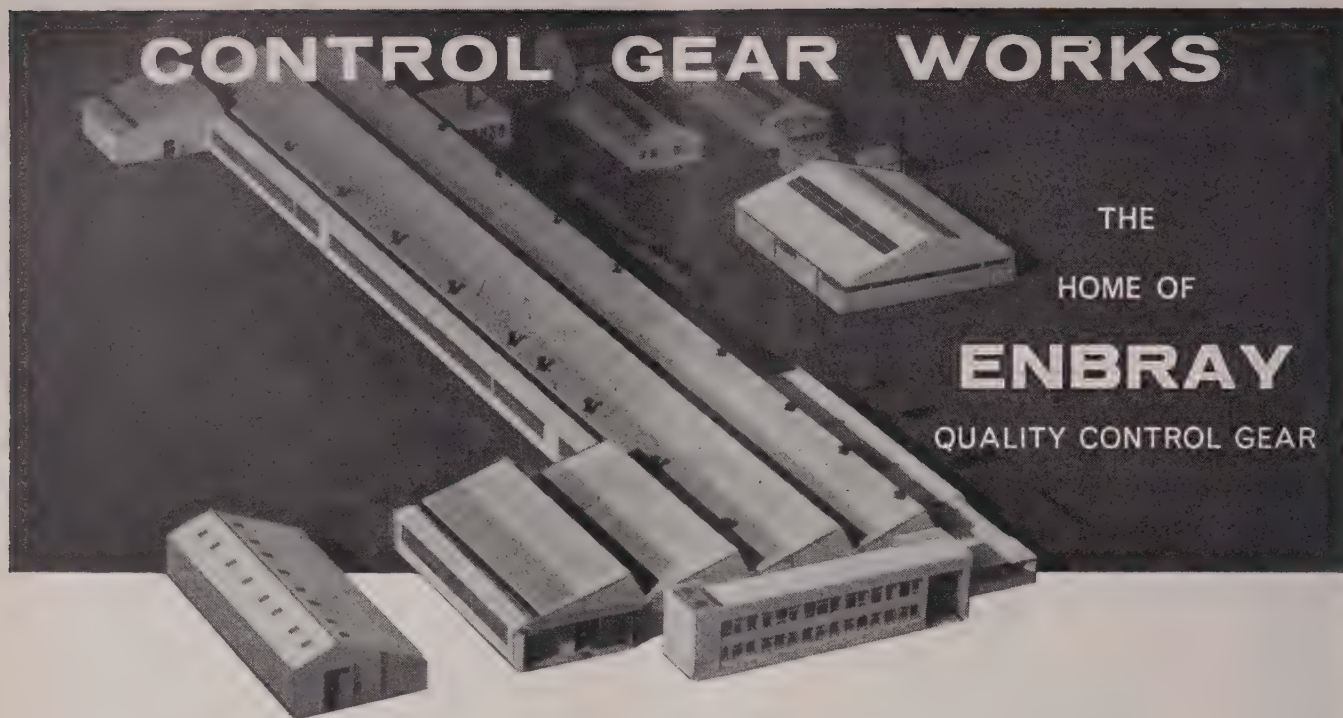
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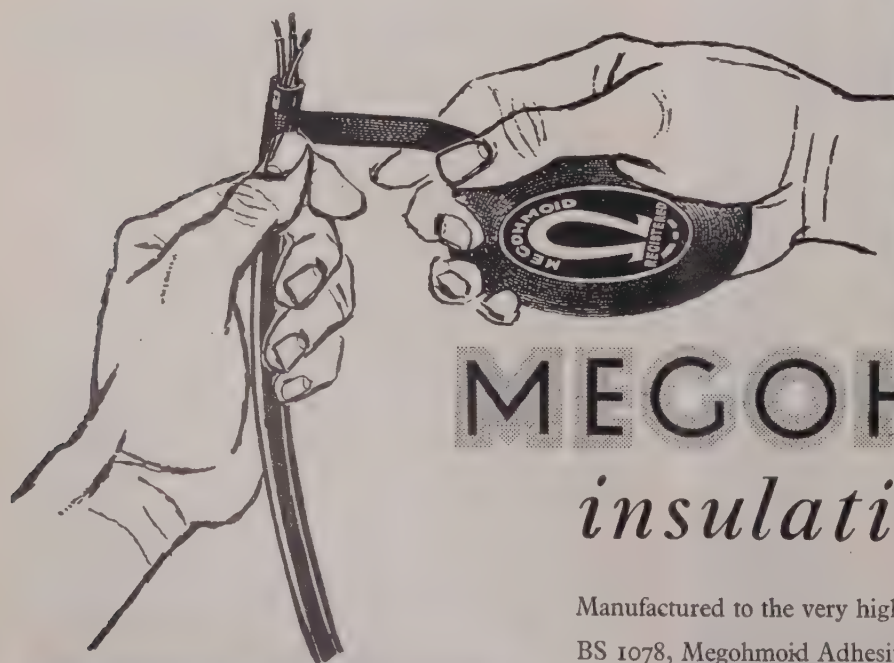
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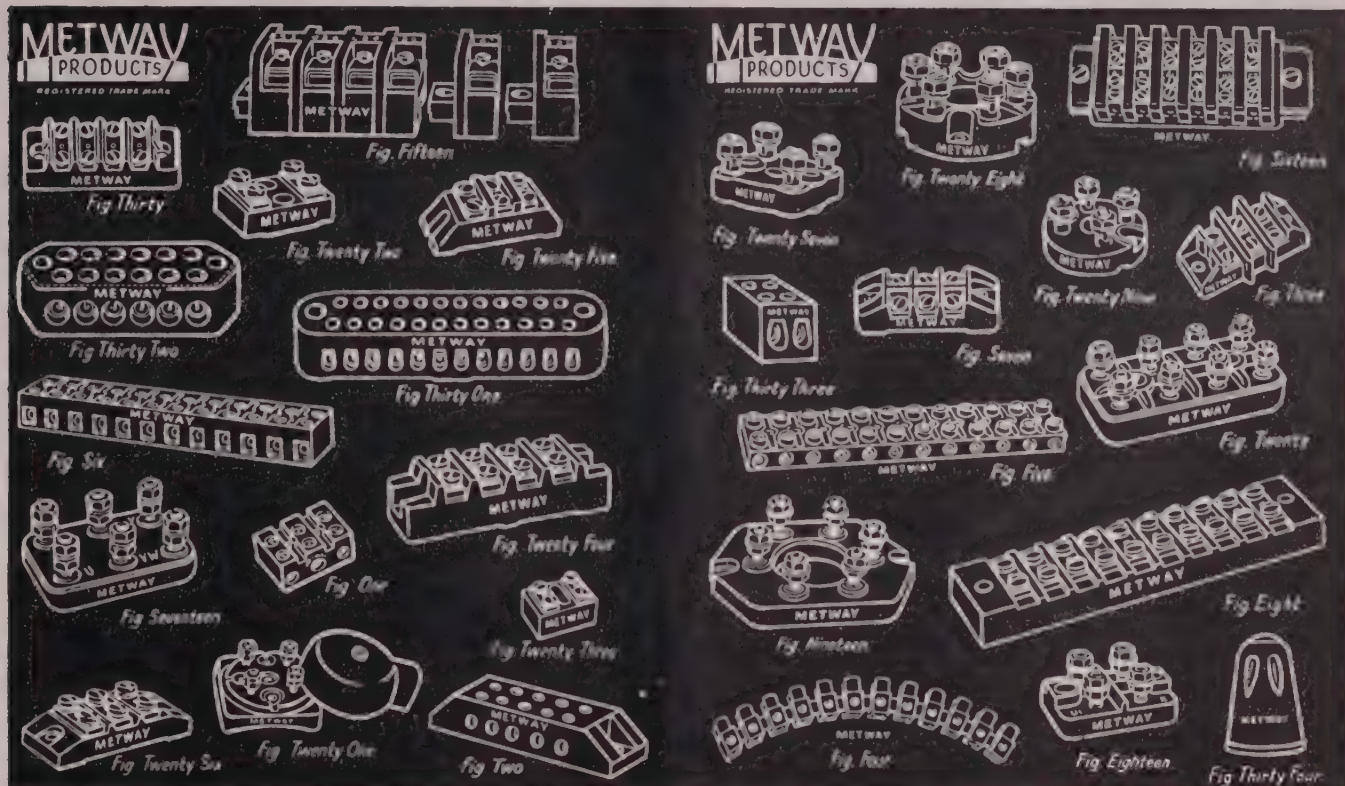
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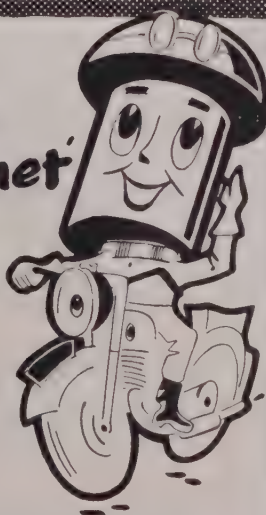
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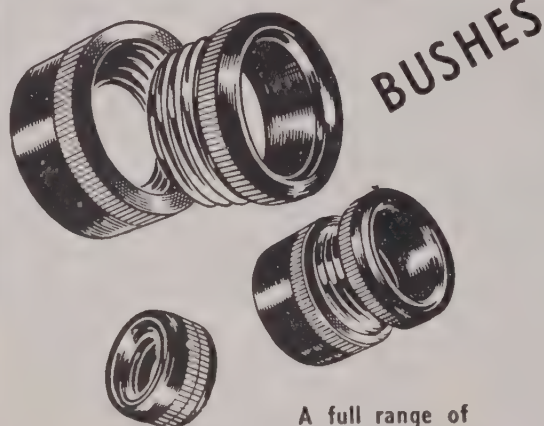
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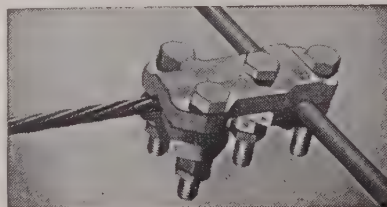
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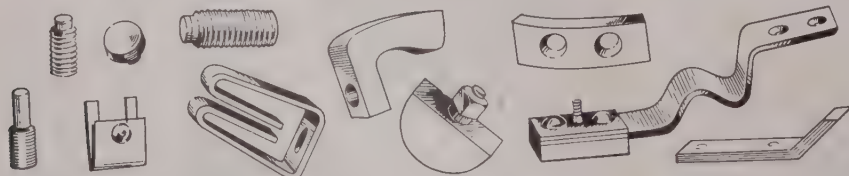
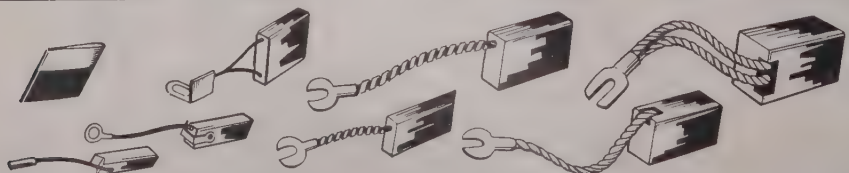
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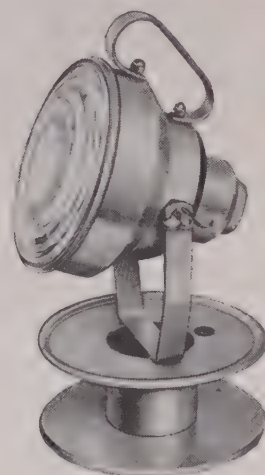
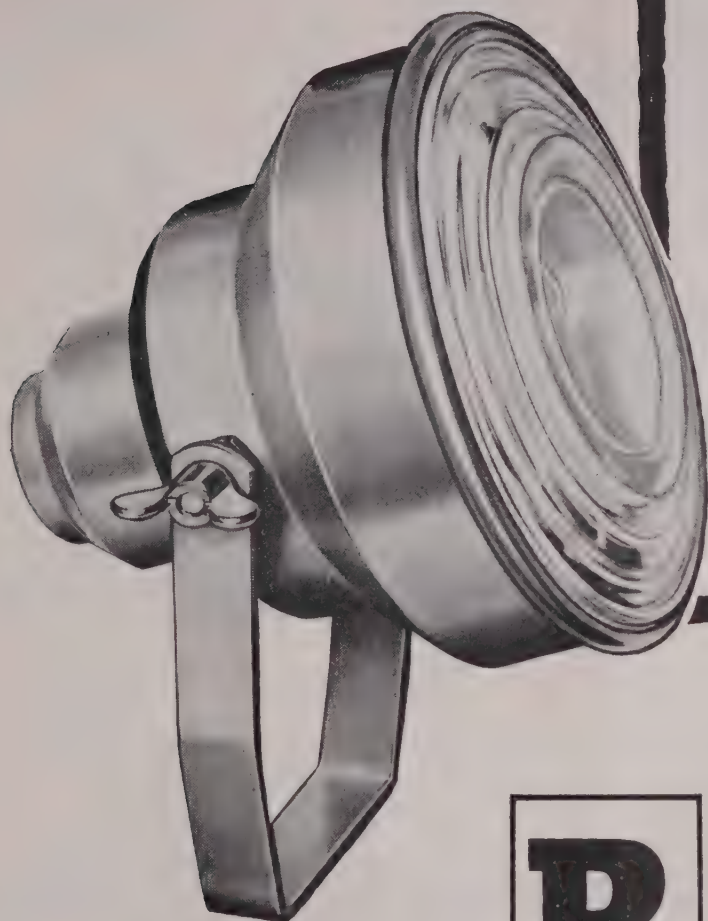
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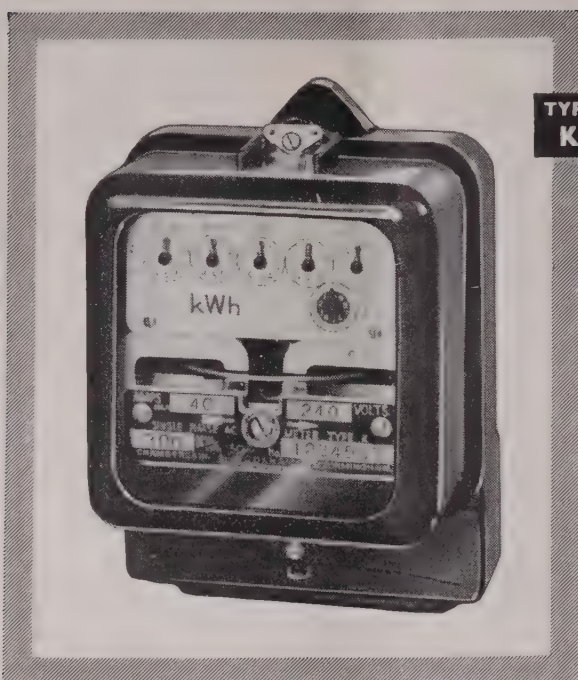
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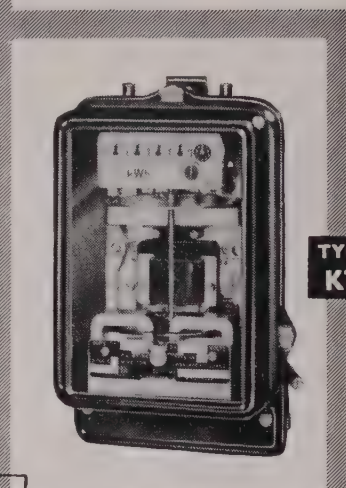
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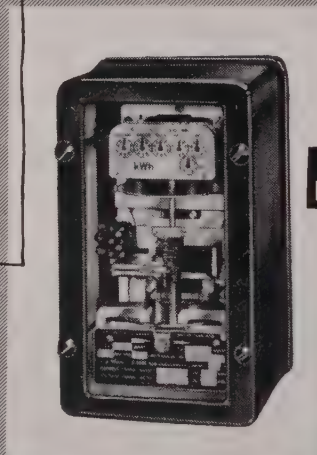
**TYPE
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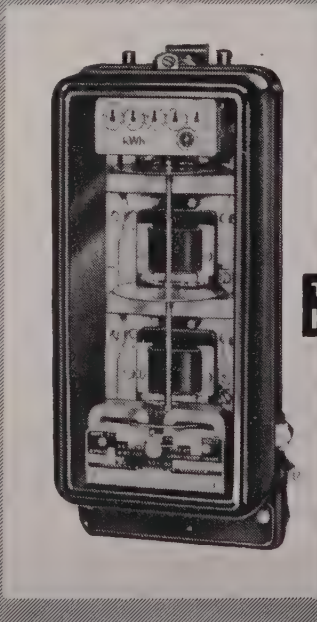
**TYPE
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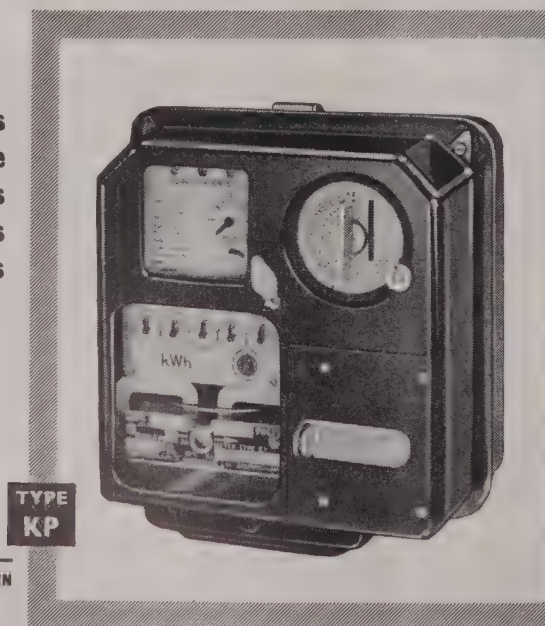
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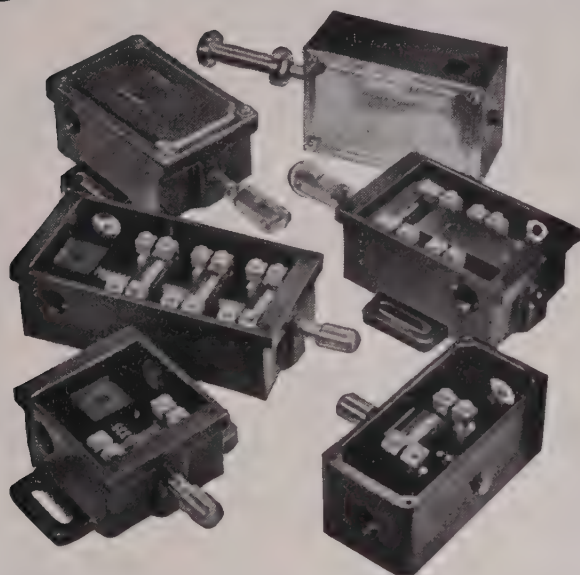
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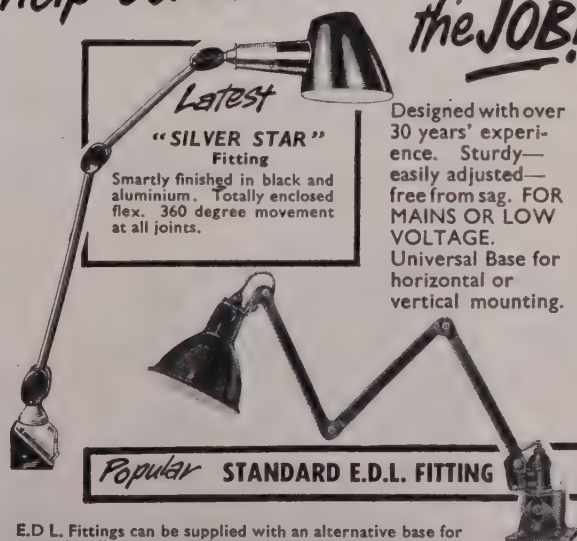
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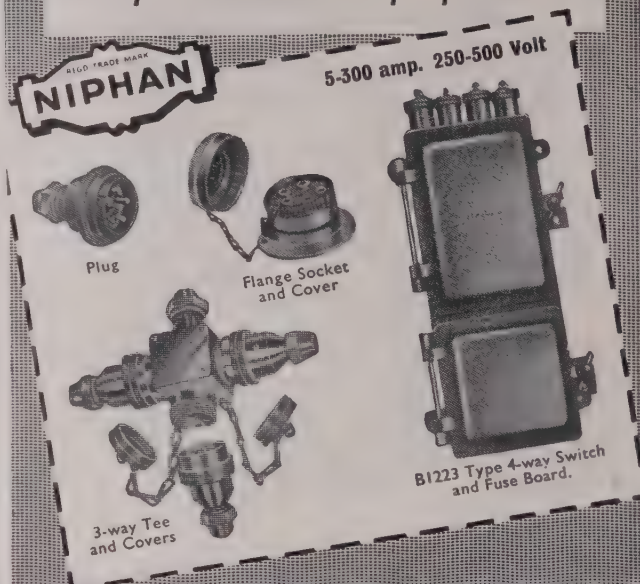
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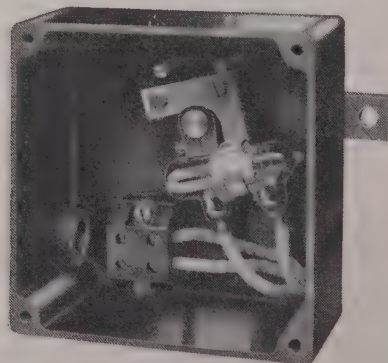
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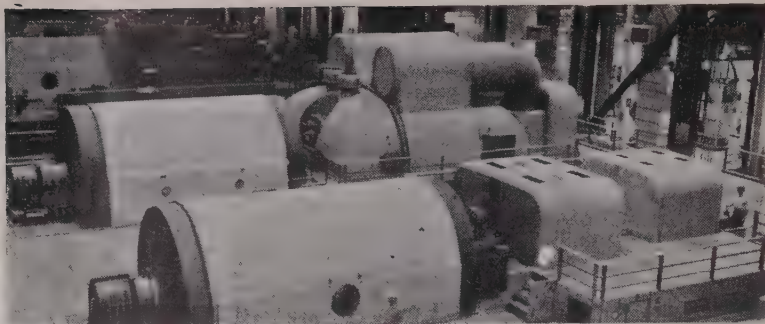
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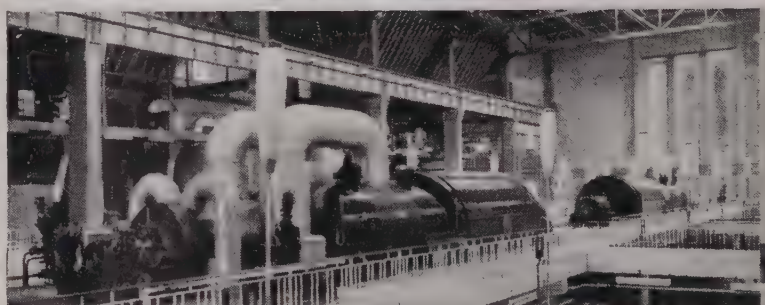
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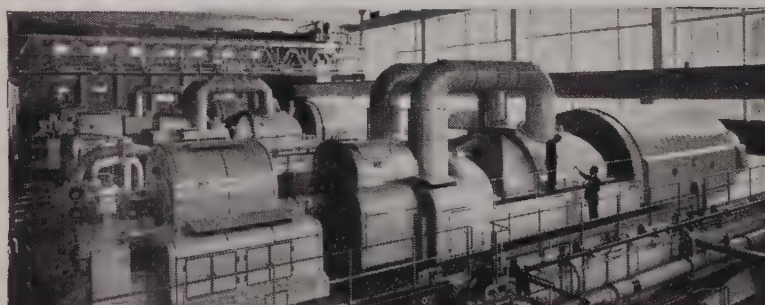
One of three PARSONS 120 MW turbo-generators at Kincardine power station, Scotland



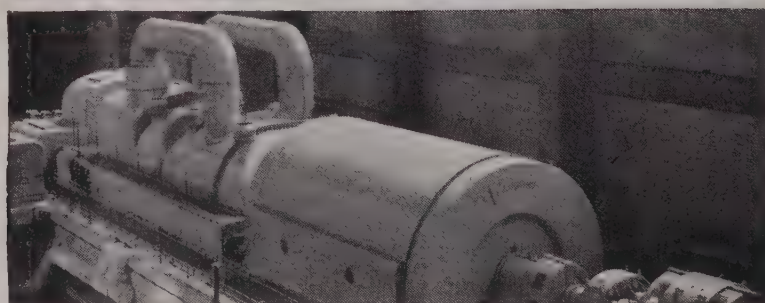
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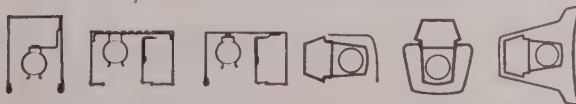


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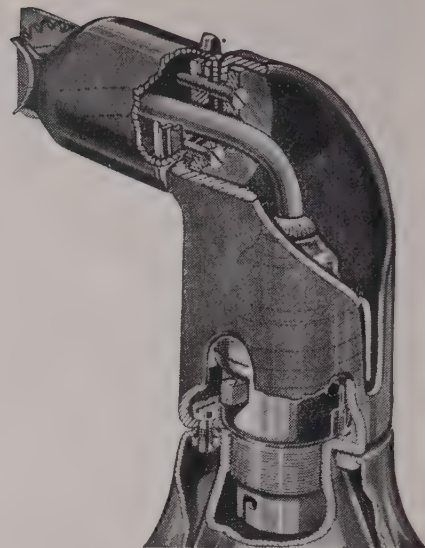
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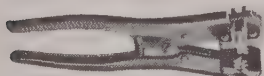
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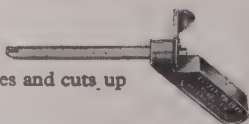


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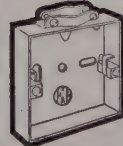
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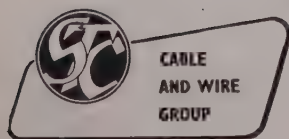
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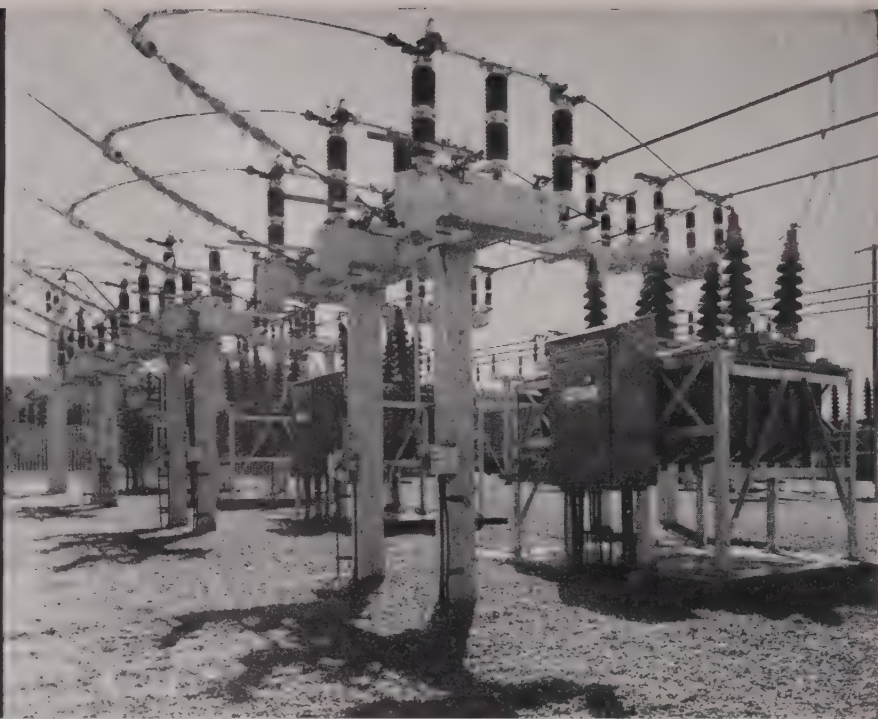
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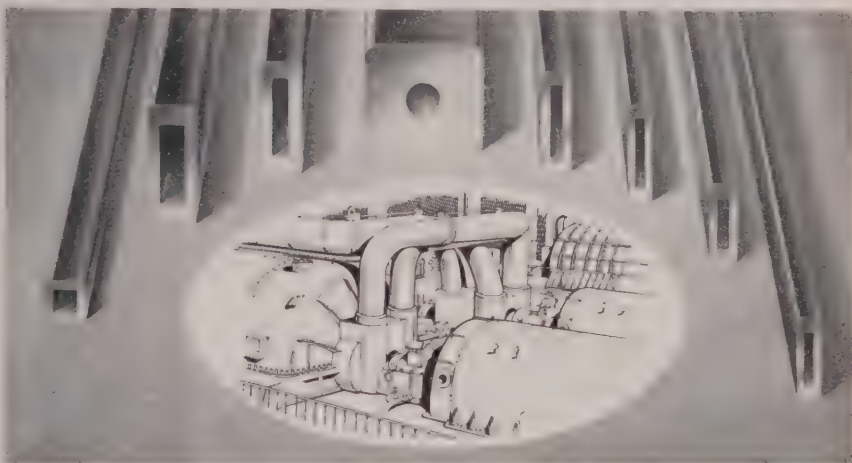
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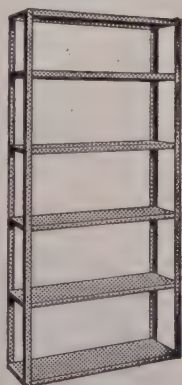
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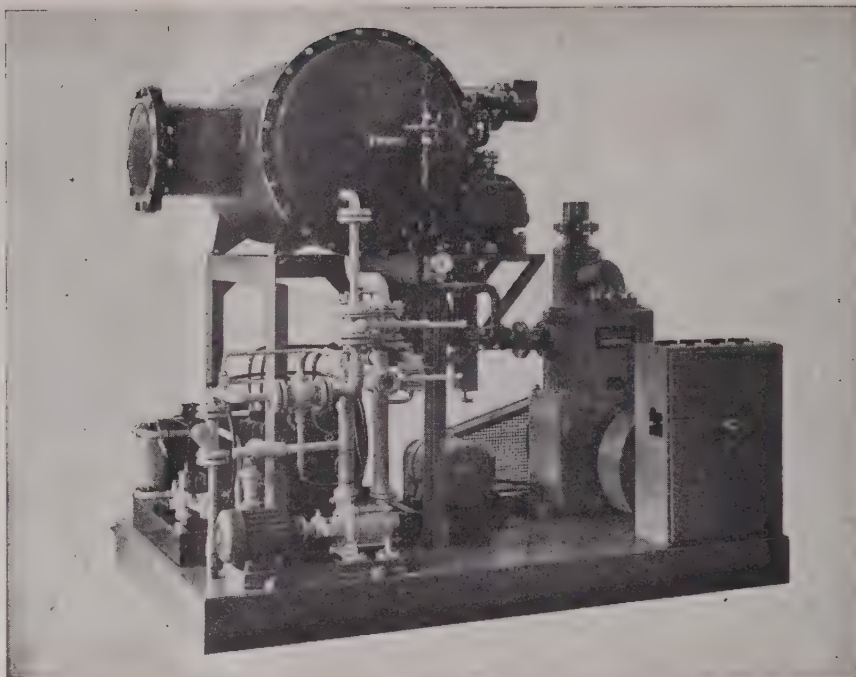


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Impregnation economy

The "Vaportherm 20" is a small self-contained pump set, capable of removing 20,000 cubic metres of water vapour per hour at a pressure of 0.1 torr. Occupying only 40 square feet of floor area, it can handle paper weights in the range of 2 to 6 tons, showing a substantial reduction in process time when replacing pumps on existing plants.



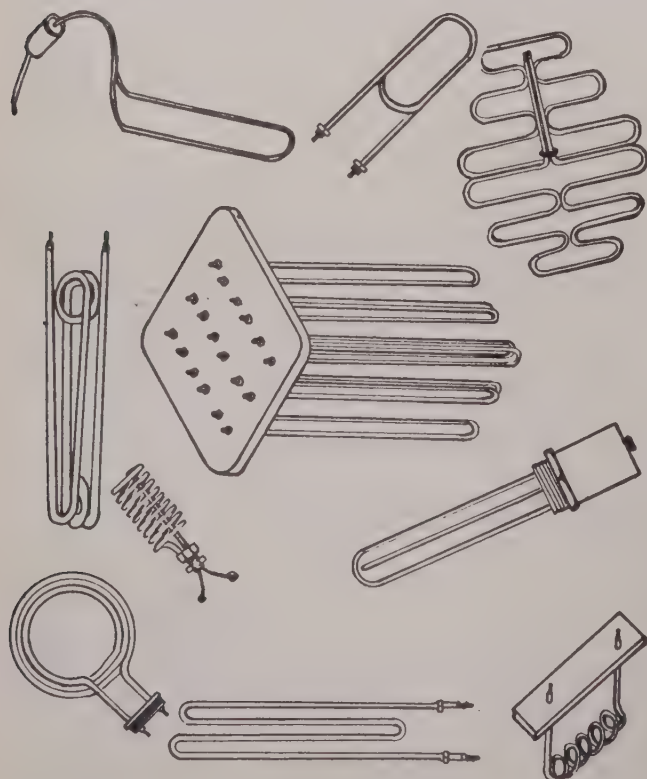
Please write for brochure containing full details to:—

LEYBOLD-ELLIOTT LTD *Specialists in Industrial Vacuum Plant*

MANOR WAY BOREHAMWOOD HERTS

Telephone: ELStree 3636

ELTRON for ELEMENTS



ELTRON (London) LTD., Strathmore Road, Croydon

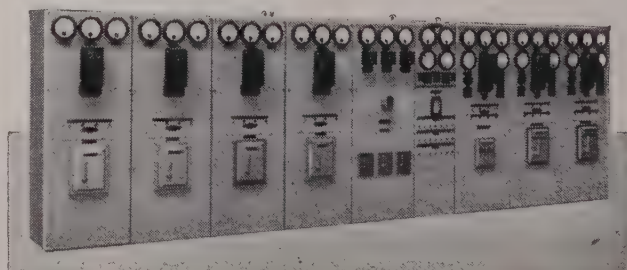
Telephone: Thornton Heath 1861

SPECIAL SWITCHBOARDS AND ELECTRONIC CONTROL PANELS

Below is shown a multi-control and feeder panel with push button circuit breaker control and metering equipment for a 1000 kVA substation. It incorporates electronic timers for process timing of a number of machines in a large factory engaged on automation.



Hampson will design and make any control panel to suit any requirements.



HAMPSON INDUSTRIES LIMITED

WEST BROMWICH, ENGLAND

Cables: HAMPGEAR, West Bromwich

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 4/- per line (approx. 6 words).

DISPLAYED CLASSIFIED:—53/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Remittances payable to "ELECTRICAL REVIEW."

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement. c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

OFFICIAL NOTICES, TENDERS, ETC.

THE COQUET WATER BOARD

Filtration Works and Pumping Station,
Warkworth: Contract No. 14

TENDERS are invited for the provision, installation and connection at the site at Warkworth of the following cables:—

- 3,300 and 1,100-volt grade P.I.L.C. power cables between switchgear and transformers.
- 3,300 and 1,100-volt grade P.I.L.C. motor cables between starters, speed regulators, power factor improvement capacitors and motor stator and rotor terminal boxes.
- 250-volt grade P.V.C. armoured remote and automatic control cables between switchgear, starters, motors, regulators, the instrument board, the control desk and auxiliary plant.
- 250-volt grade P.V.C. armoured remote indication and metering cables between switchgear, starters, motors, regulators, the instrument board, the control desk and auxiliary plant.

Specifications may be obtained on application to Mr. S. G. Barrett, M.I.C.E., Engineer and Manager, The Coquet Water Board, P.O. Box 104, Pilgrim Street, Newcastle upon Tyne, 1.

TENDERS to be returned in the envelope provided to the undersigned not later than 10 a.m. on the 28th February, 1961. The Board do not bind themselves to accept the lowest or any tender and reserve the right to accept the whole or part of any tender received.

F. G. EGNER,
Clerk and Solicitor
to the Board.

14, Northumberland Square,
North Shields. 7515

BOROUGH OF WIDNES

THE Corporation invite tenders for the supply of the unmentioned materials required in the Highways Department during the twelve months ending 31st March, 1962:—

1. Electrical Equipment.
2. Electric Lamps.
3. Gas Fittings and Mantles.

Forms of tender, specification and envelopes in which the tenders must be submitted may be obtained from F. A. J. Knight A.M.I.C.E., M.I.Mun.E., Borough Engineer and Surveyor, Town Hall, Widnes.

Tenders in envelopes provided to be forwarded to reach the undersigned not later than 9 a.m. on Thursday, 16th February, 1961.

The Council do not bind themselves to accept the lowest or any tender.

FRANK HOWARTH,
Town Clerk.
Widnes, Lancs. 7463

ILMINSTER URBAN DISTRICT COUNCIL

TENDERS are invited for the supply and erection of 64 140-watt Sodium Discharge Lamps on Trunk Road A.303, Ilminster.

Specification, etc., may be obtained from N. J. Arney, Surveyor, Council Offices, Ilminster, and tenders, in plain sealed envelopes, endorsed "Street Lighting," should be received by the undersigned not later than first post on 21st February, 1961.

B. COOPER,
Clerk of the Council.
Ilminster, Somerset. 7516

CITY OF BELFAST

Electricity Department

TENDERS are invited for the supply, delivery and erection of:—

33/6.6 kV, 12,500 kVA STEP-DOWN TRANSFORMERS.

Form of tender and specification (No. W.187), in duplicate, may be obtained at the Electricity Department, East Bridge Street, Belfast, 1, on payment of a deposit of Two Guineas, which amount will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies of the contract documents may be obtained at One Guinea each, which sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender (original only), in sealed envelope marked "Tender for 33/6.6 kV, 12,500 KVA Step-Down Transformers, Electricity Committee" and endorsed with the name and address of the tenderer, must reach the undersigned not later than 4 p.m. on Friday, 3rd March, 1961.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.
P.O. Box 234,
City Hall, Belfast, 1. 7583

BOROUGH OF EALING

Renewal of Electrical Installations at Drayton Infants' School and Perivale Primary School

TENDERS are invited from approved N.I.C.E.C. contractors for the above-mentioned work. Specification and tenders from Borough Engineer, Town Hall, Ealing, London, W.5, on receipt of deposit of £1 each, returnable on receipt of a bona fide tender. Closing date 23rd February, 1961.

E. J. COPE BROWN,
Town Clerk. 7440

THE INDIA SUPPLY MISSION, WASHINGTON, D.C.

invites tenders for the supply of CARRIER COMMUNICATION EQUIPMENT for the Dhuvaran (Cambay) Thermal Station Project of the Gujarat Electricity Board.

Tender forms may be obtained from India Store Department, C.D.N. Branch, Bromyard Avenue, Acton, London, W.3, on payment of 2s. 6d., which amount is not refundable. Tender number SE-287 to be quoted in all applications. Closing date for the receipt of the tenders in Washington is 28th February, 1961.

7584

COUNTY BOROUGH OF CROYDON

To Electrical Contractors

TENDERS are invited for installing power plug sockets and other electrical work in 720 pre-war Council Houses (divided into 3 groups) on the Mitcham Road Estate.

Further particulars and tender forms obtainable from the Housing Manager, 71, Park Lane, Croydon. Closing date for tenders, 17th February, 1961.

E. TABERNER,
Town Clerk. 7575

Advertisements are accepted up to first post on Monday of the week of issue

If blocks, bold type or ruled borders are required then on Friday prior to week of issue

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

INDIA STORE DEPARTMENT

THE Office of the Director General, Government Building, Bromyard Avenue, Acton, London, W.3, invites tenders for the following:

TENDER ENQUIRY: FOR THE SUPPLY OF DIESEL ALTERNATORS, 25-kVA CAPACITY, COMPLETE WITH SWITCHGEAR. QUANTITY, 4 SETS.

Specifications, etc., relative to the above enquiry can be obtained from the Co-ordination Branch, India Store Department, Bromyard Avenue, Acton, London, W.3, at a cost of 10 shillings per tender and is not refundable.

Tenders are to be returned to India Store Department at the above address so as to reach them by Monday, 6th March, 1961.

Specimen copy of the enquiry can be seen at India Store Department, Engineering Branch, Bromyard Avenue, Acton, London, W.3, under the following reference, 2368/60/SMM/ENG.4

7527

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

AIR MINISTRY

Works Design Branch

requires in London and Provinces **ENGINEERING DESIGNER DRAUGHTSMEN** experienced in preparation of schemes for illumination and electrical equipment of buildings or schemes for H.V. and M.V. electrical distribution. Candidates should have served recognised apprenticeship or had equivalent training, and also have had practical experience. O.N.C. an advantage. Financial assistance and time off for recognised courses of study. Promotion and pension prospects. 5-day week with 18 days' paid leave per year initially. Overseas tours for which special allowances granted.

Salary in LONDON ranges from £805 (age 25) to £980 p.a.; somewhat lower in PROVINCES. Commencing salary dependent on age, qualifications and experience.

Applicants, who must be natural-born British subjects, should write quoting O/N Kings Cross 4354 to Air Ministry, W.G.d, Theobalds Road, London, W.C.1, or to any Employment Exchange, giving age, details of training, qualifications, full particulars of former posts held and copies of any testimonials. Candidates selected will normally be interviewed in London and certain expenses reimbursed.

250

TRANSFORMERS

A WELL-KNOWN company in the S.W. London Area requires **INTERMEDIATE AND JUNIOR DRAUGHTSMEN** with some experience on Power Transformers in range 10-30,000 kVA. Permanent positions carrying excellent salaries according to experience. Contributory pension and life assurance scheme in operation and canteen facilities provided. Evening and Saturday interviews can be arranged. Write stating age, experience and education to—Box 7577.

Situations Vacant (continued)

BRITISH RAILWAYS

RAILWAY ELECTRIFIED LINES
OVERHEAD MAINTENANCE STAFF

VACANCIES exist on the Eastern Region Electrified Lines in the London Area. Applicants selected will be engaged as ASSISTANT OVERHEAD TRACTION LINEMEN at a base rate of £9 18s. per week. The average earnings for this grade amount to approximately £13 per week. Shift working is involved.

Courses of instruction are given and good opportunities exist for promotion to higher grades. Certain free and reduced rate rail travel facilities. Pension and sick pay schemes.

Apply giving full particulars of age, experience, etc., to

Electric Traction Engineer (London Area)
BRITISH RAILWAYS, EASTERN REGION
Off Ley Street, Ilford, Essex

7541

ELECTRICAL
INSULATION ENGINEER

Applications are invited from qualified electrical engineers for a new position concerned with the design of High Voltage Bushings and the technical problems arising in their construction.

The post offers considerable scope and interest in this field and applicants must possess good relevant experience.

The Company is actively concerned with new developments in all aspects of electrical insulation and offers good career prospects and conditions of service.

Applications giving details of age, experience, qualifications and current salary, should be sent to

Personnel Manager
THE MICANITE & INSULATORS CO. LTD.
Empire Works, Blackhorse Lane
Walthamstow, London, E.17

7548

MINISTRY OF AVIATION

require an ENGINEER III in Air Technical Publications Branch, Chessington, Surrey, to prepare and/or supervise contractors' preparation of technical publications for Services on theoretical and practical aspects of special weapon and navigational systems and associated test equipment.

Quals.: Recognised engineering apprenticeship or equiv. training, and Corporate Membership of Institution of Mechanical, Electrical or Civil Engineers, or have exempting quals. Experience in electrical and instrument fields, and knowledge of application of electronics in control and monitoring systems. Experience in writing and/or editing of technical matter desirable.

Salary £830 (age 25) to £1,300 p.a. (London scale). Commencing salary £1,125 p.a. at age 34 or over. Not established, but opportunities to compete for establishment may arise.

Forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.12/1A. 7504

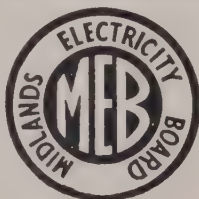
SENIOR
ESTIMATING ENGINEER

required for London office of national contractor, capable of preparing tenders and designing all types of commercial and industrial installations. Bonus scheme in operation in addition to salary.

Apply in writing, giving full details of qualifications, age, experience, etc., or telephone for an appointment.

DUNCAN WATSON
(ELECTRICAL ENGINEERS) LTD.
60, Worship Street, London, E.C.2
Telephone No. BIS. 4752

7534

MIDLANDS
ELECTRICITY
BOARD

APPLICATIONS are invited for the following superannuable posts:—

Central Gloucestershire Sub-Area
THIRD ASSISTANT DISTRICT
ENGINEER (Gloucester).

Experience necessary in the construction, operation and maintenance of large H.V. and M.V. underground and overhead distribution systems. Technical qualifications desirable. Salary £890/£1,015 per annum (N.J.B. Grade F.9).

Apply by letter, within 14 days, stating age, experience, present position and salary to Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, Eastern Avenue, Gloucester.

North Staffs. Sub-Area
THIRD ASSISTANT DISTRICT
ENGINEER (Newcastle).

Duties include the construction, operation and maintenance of H.V. and M.V. mains and substations, and applicants should have had experience in the planning of system reinforcements and mains extensions. Salary £890/£1,015 per annum (N.J.B. Grade F.9).

Apply by letter, within 10 days, stating age, experience, present position and salary to Mr. C. C. Pimble, Sub-Area Manager, Midlands Electricity Board, 234, Victoria Road, Fenton, Stoke-on-Trent.

F. W. CATER,
Secretary. 7549

CITY OF SALISBURY
ELECTRICITY DEPARTMENT

Vacancy for Electrical Engineer (Protection)

Salary Scale £1,025 × £1,025 10s. to £1,332 10s.
× £76 17s. 6d. to £1,563 2s. 6d. × £51 5s.
to £1,768 2s. 6d. per annum.

APPLICATIONS are invited for the fixed establishment post of ELECTRICAL ENGINEER (Protection) in the Salisbury Municipal Electricity Department on the scale £1,025 × £1,025 10s. to £1,332 10s. × £76 17s. 6d. to £1,563 2s. 6d. × £51 5s. to £1,768 2s. 6d. per annum. No allowances are payable.

Commencing salary is based on qualifications and experience. There is a barrier at £1,563 2s. 6d. per annum, above which no engineer can rise without being a Corporate Member of the British Institution of Electrical Engineers, and the maximum entry point into the grade is £1,614 7s. 6d. per annum.

Candidates must be Graduates of the British Institution of Electrical Engineers and/or hold an equivalent electrical engineering degree, and have had not less than five years' experience in general protection work.

Consideration, however, will be given to applicants who have not the above qualifications but who have had extensive practical experience. The salary scale applicable in such instance will be £1,568 5s. × £51 5s. to £1,722 per annum, commencing salary being at the minimum of the grade.

The successful applicant will work under the direction of the Test Engineer in the Consumers' Engineer's Section and his duties will comprise mainly:—

1. Design and commissioning of all types of protection schemes on generators, feeders, motors, transformers and other types of electrical equipment.
2. Determination of relay settings and the calculation of fault currents over the system. Supervision of staff engaged in the maintenance and repair of all relays and instruments associated with protection schemes.

The department has an extensive supervisory indication, control and telemetering scheme, and experience with similar equipment is desirable. Experience with electronic equipment would be considered an advantage.

The appointment will be subject to the City Council's Service and Leave Regulations. The successful candidate will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months, and if thereafter confirmed in his appointment, to join the Southern Rhodesia Local Authorities Joint Pension and Widows' and Orphans' Fund. He must also be able to comply with the requirements of the Federal Immigration Authorities.

Candidates must submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received. Age, place of birth, nationality and marital state should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Messrs. Merz & McLellan, Carlisle House, Newcastle upon Tyne, 1, quoting reference PN, to whom applications must be submitted on or before 17th February, 1961. 7522

ELECTRICAL ENGINEER

Ministry of Health, Water and Sanitation,
Government of Trinidad

QUALIFICATIONS: Candidates must be Grad. I.E.E. with at least 5 years' post-qualification experience in electrical installation and in particular heavy duty pumping equipment.

Duties: To organise and operate the Electrical Section for the maintenance and operation of all electrical installations and associated equipment in the Water Department, and to advise on electrical matters.

Terms of Appointment: Contract/gratuity terms for one tour of 4 years with salary in the scale of £1,000-£1,500. Free passages.

Write Director of Recruitment, Colonial Office, London, S.W.1, giving full names, age, qualifications and experience, quoting reference BCD.117/38/052/D11. 7517

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE OPERATIONAL STAFF

The engineering organisation of the Rutherford High Energy Laboratory is being expanded and technical staff are required to work in a group concerned with the operation of a large Proton Synchrotron which will be used in the Laboratory's research programme.

Applicants with a sound basic engineering training and possessing good experience in the control of large power plant are required to undertake the control room duties of a 120 MVA power plant comprising a large motor alternator set feeding transformers and an associated converter installation.

If you are interested in joining this new organisation then please send a postcard for further details to the Recruitment Officer.

Possession of an appropriate National Certificate in Electrical Engineering together with a general knowledge of converter or rectifier installations, control and protection systems and industrial electronics would be an advantage. Several posts are available, the salary being in the range £1,015 to £1,410 according to age and experience.

The Rutherford High Energy Laboratory is a centre for research into fundamental nuclear science and is being constructed adjacent to the Atomic Energy Establishment at Harwell.

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

Harwell, Berkshire, quoting Reference No. VN28/48

7539

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

PLANT SHIFT CONTROL ENGINEER, DRAKELOW "B" POWER STATION (Vacancy No. 12/61).

Applications are invited for the position of PLANT SHIFT CONTROL ENGINEER at Drakelow "B" Power Station, near Burton-on-Trent, Staffs.

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience.

Technical qualifications to Higher National standard desirable.

Salary will be in accordance with Class L, Grade 10 (£1,190-£1,325 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 10th February, 1961.

STATION SHIFT CONTROL ENGINEER, LEICESTER POWER STATION (Vacancy No. 15/61).

Applications are invited for the position of STATION SHIFT CONTROL ENGINEER at Leicester Power Station, Rawdykes Road, Leicester.

Candidates should be experienced in control room operation. A Higher National Certificate would be an advantage.

Salary will be in accordance with Class G, Grade 10 (£890-£1,015 per annum) of the National Joint Board Agreement, plus shift allowance.

Closing date for receipt of applications, 17th February, 1961.

GENERAL ASSISTANT ENGINEER, DERBY POWER STATION (Vacancy No. 17/61).

Applications are invited for the position of GENERAL ASSISTANT ENGINEER at Derby Power Station, Full Street, Derby.

Candidates should be suitably qualified young men who are interested in power station operation and/or maintenance as a career.

Facilities are available whereby experience can be obtained in all sections of a modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge, and will be within the range £625-£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 17th February, 1961.

SHIFT CHARGE ENGINEER, BURTON-ON-TRENT POWER STATION (Vacancy No. 18/61).

Applications are invited for the position of SHIFT CHARGE ENGINEER at Burton-on-

Trent Power Station, Wetmore Road, Burton-on-Trent, Staffs.

Sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualifications an advantage.

Salary will be in accordance with Class E, Grade 7 (£965-£1,090 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 17th February, 1961.

FIRST ASSISTANT STATION CHEMIST, LEICESTER POWER STATION (Vacancy No. 19/61).

Applications are invited for the position of FIRST ASSISTANT STATION CHEMIST at Leicester Power Station, Rawdykes Road, Leicester.

Previous experience in a power station laboratory is essential and candidates should, at least, hold the H.N.C. in Chemistry. Candidates must be familiar with methods of sampling and analysis of coal, oil and water, and with the interpretation and application of analytical results.

Salary will be in accordance with Class G, Grade 9 (£965-£1,090 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th February, 1961.

PLANNING ENGINEER, WILLINGTON "A" and "B" POWER STATION (Vacancy No. 20/61).

Applications are invited for the position of PLANNING ENGINEER at Willington "A" and "B" Power Station, P.O. Box 27, Derby.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are corporate members of a recognised professional institution or who hold qualifications leading to such membership, and candidates should have a clear and objective approach to power station planning problems.

Salary will be in accordance with Class M, Grade 6 (£1,650-£1,830 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th February, 1961.

EFFICIENCY ENGINEER, WILLINGTON "A" and "B" POWER STATION (Vacancy No. 21/61).

Applications are invited for the position of EFFICIENCY ENGINEER at Willington "A" and "B" Power Station, P.O. Box 27, Derby.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are corporate members of a recognised pro-

fessional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class M, Grade 6 (£1,650-£1,830 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th February, 1961.

SECOND ASSISTANT STATION CHEMIST, LEICESTER POWER STATION (Vacancy No. 22/61).

Applications are invited for the position of SECOND ASSISTANT STATION CHEMIST at Leicester Power Station, Rawdykes Road, Leicester.

Experience of analyses of fuel, water and oils is desirable and educational standard up to Higher National Certificate would be an advantage.

Salary will be in accordance with Class G, Grade 11 (£825-£940 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th February, 1961.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent concerned, and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.

27th January, 1961.

7591

NORTH WESTERN ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER, SUB-AREA ENGINEERING DEPARTMENT, PRESTON.

Applicants must have had sound training in the testing and maintenance of protective gear. Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary scale £965/£1,090 p.a., Grade L.13. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 4 Sub-Area, North Western Electricity Board, 40/41, Lune Street, Preston, and returned to him by the 13th February, 1961.

ASSISTANT (WAYLEAVES), SUB-AREA SECRETARIAL DEPARTMENT, KENDAL.

Applicants should be experienced in the negotiation of wayleaves, the keeping of registers, the settlement of claims for damages arising out of the construction of supply lines, and the selection of and preliminary negotiations for substation sites.

Salary scale £700 × £25 to £775 p.a., Grade 2. N.J.C. conditions.

Applications on forms to be obtained from the Manager, No. 6 Sub-Area, North Western Electricity Board, Castle Green, Kendal, and returned to him by the 13th February, 1961.

7523

Situations Vacant (continued)**CITY OF LIVERPOOL
EDUCATION COMMITTEE**City College of Technology,
Byrom Street, Liverpool, 3Principal: S. A. J. Parsons, B.Sc.(Econ.),
M.I.Mech.E., M.I.Prod.E., M.B.I.M.**Department of Electrical Engineering**

APPPLICATIONS are invited from suitably qualified persons for the appointment of **SENIOR LECTURER** in Electrical Engineering (Heavy Current) (full-time).

Salary £1,550 × £50 to £1,750 per annum (1959 Burnham Technical Report). Increments within the scale may be added to the commencing salary for approved industrial or professional experience or research work of an equivalent standard.

Applicants should have experience on electrical machines and electricity supply. An honours degree in electrical engineering is essential; an appropriate professional qualification is desirable, together with teaching, industrial and/or research experience. The person appointed would be encouraged to undertake research and would be expected to organise postgraduate courses.

Application form (returnable by 17th February, 1961) and further particulars from H. S. Magnay, M.A., Director of Education, 14, Sir Thomas Street, Liverpool, 1.

THOMAS ALKER,

Town Clerk and Clerk to the
Local Education Authority.

(J.6678)b

7512

**FEDERAL GOVERNMENT
OF NIGERIA**

require

**ELECTRICAL
SUPERINTENDENT
(P.W.D.)**

AN Electrical Superintendent is required by the Works Division of the Federal Ministry of Works and Surveys to supervise the work of electrical contractors and maintain electrical installations in government buildings, hospitals, staff quarters, etc., under the direction of the Senior Electrical Engineer. The officer appointed will also be required to demonstrate to contractors' staff or other workmen modern methods of installations and be prepared to pass on specialised knowledge to them. Candidates, who should be between the ages of 28 and 50, must have successfully completed an appropriate five-year apprenticeship, had a minimum of two years' responsible experience in electrical contracting work in a supervisory capacity, and considerable experience in re-winding of fractional horse-power and large motors. The possession of a City and Guilds Certificate in Electrical Installation work would be an advantage and it is desirable to have a knowledge of the electrical maintenance of air conditioning and oil engine standby generating plant.

Appointment on contract for one tour of 15 to 18 months in the first instance. Salary, according to age and experience, £1,056 p.a. to £1,692 p.a. (including inducement addition) plus gratuity of £100 to £150 p.a. for satisfactory service. An outfit allowance of £60 is paid on salaries not exceeding £1,740.

Free passages for officer and wife. Children's allowances whilst separated. Home leave on full pay. Income tax at low local rate. Rent at low cost.

Candidates should write for further particulars, stating age, qualifications and experience, to the Recruitment Attaché, Office of the High Commissioner for Nigeria, Nigeria House, 9, Northumberland Avenue, London, W.C.2, quoting V.13/1.

7528

**Associated Electrical Industries Limited****INSULATION
DEVELOPMENT**

GRADUATE ELECTRICAL ENGINEER required for interesting work on the development of insulation systems for rotating machines. The work involves the evaluation of insulation materials and systems using model systems such as motorettes, and there is scope for initiative in developing new testing techniques. Some previous experience in this field would obviously be an advantage but it is not essential; enthusiasm would be equally acceptable.

Please write for application form, quoting reference G.18 to:—

Personnel Manager

Associated Electrical Industries (Manchester) Ltd.

Trafford Park, Manchester, 17

7472

**AN ELECTRICAL ESTIMATOR
is required by our Purchasing Staff
as a Technical Assistant**

Applicants must be able to evaluate tenders for all classes of industrial electrical installation, negotiate contractors' prices from tender to final account and have a general knowledge of contract document procedure.

Applications quoting age, training and experience should be addressed to

MR. V. W. WILLIAMS

TRAINING AND RECRUITMENT DEPARTMENT

FORD MOTOR COMPANY LIMITED - DAGENHAM - ESSEX

7501

BRITISH RAILWAYS

require

ELECTRICAL FITTERS

for maintenance of electrical equipment on the Distribution Section of the Eastern Region Electric Traction System in the London Area. Applicants must have served a recognised apprenticeship. Experience with H.V. switchgear and/or control system an advantage. Shift working is involved.

Rate of pay is the equivalent of £11 13s. 6d. per standard week of 44 hours, plus appropriate shift allowance which averages 33s. per week, and enhanced pay for overtime and Sunday duty.

Applicants will be required to undergo medical examination. Certain free and reduced rate rail travel facilities. Pension and sick pay schemes. Prospects of promotion.

Apply in writing giving details of age, experience, etc., to the

Electric Traction Engineer (London Area)

BRITISH RAILWAYS, EASTERN REGION

Off Ley Street, Ilford, Essex

7538

EAST MIDLANDS ELECTRICITY BOARD**Leicestershire and Warwickshire Sub-Area****FOURTH ASSISTANT ENGINEER**

(Re-advertised Vacancy No. 129/60).

Salary N.J.B. Class K, Grade 12, £965 to £1,090 per annum.

Duties include H.V. network calculations, fault analysis, reporting, and generally to assist the Operations and Maintenance Engineer. Ability to drive a car would be an advantage, and the successful applicant will be required to reside in or near Hinckley.

Applications should be forwarded to the Manager, Leicestershire and Warwickshire Sub-Area, Upper Bond Street, Hinckley, Leics., within fourteen days of the date of this advertisement.

Nottingham Sub-Area**FOURTH ASSISTANT DISTRICT ENGINEER**

(Vacancy No. 12/61).

Salary N.J.B. Class F, Grade 10, £825 to £940 per annum.

The duties of this post will be to assist in the construction, operation and maintenance of distribution systems of all voltages up to 11 kV.

Applications should be forwarded to the Manager, Nottingham Sub-Area, 35/39, Carrington Street, Nottingham, within fourteen days of the date of this advertisement.

Area Board Headquarters**THIRD ASSISTANT ENGINEER**

(Operations)

(Vacancy No. 13/61).

Salary N.J.B. Class BX, Grade 8, £1,105 to £1,410 per annum. The starting salary will depend on the experience and qualifications of the successful candidate.

Applicants should have a sound knowledge of the operation and maintenance of underground and overhead distribution systems and associated equipment up to and including 33 kV. They should be familiar with the statutory regulations and safety rules concerning the construction, operation and maintenance of such systems, and be able to write concise and accurate reports.

THIRD ASSISTANT ENGINEER

(Construction)

(Vacancy No. 14/61).

Salary N.J.B. Class BX, Grade 8, £1,105 to £1,410 per annum. The starting salary will depend on the experience and qualifications of the successful candidate.

Applicants should be familiar with the installation of electrical plant, including transformers, switchgear, etc., and all ancillary equipment up to and including 33 kV. Ability to interpret and check switchgear and other manufacturers' drawings is essential. Experience in carrying out underground cable installations and overhead line construction, together with the erection of outdoor substations, is also required.

FOURTH ASSISTANT ENGINEER

(Technical)

(Vacancy No. 15/61).

Salary N.J.B. Class BX, Grade 10, £935 to £1,245 per annum, or Grade 9, £1,005 to £1,325 per annum, depending on the experience and qualifications of the successful candidate.

The duties of the post include assisting in the work of the section, particularly in fault analysis and reports dealing with the assessment of plant performance and tests on various types of equipment.

Applications for the above vacancies should be forwarded to the Chief Engineer, East Midlands Electricity Board, Mapperley Hall, Lutterworth Avenue, Nottingham, with fourteen days of the date of this advertisement. 7582

FAWCETT PRESTON & CO. LIMITED

(A Member of the

Metal Industries Group of Companies)

require a **SALES ENGINEER** with experience of industrial and traction resistors and their application. Preference will be given to applicants holding H.N.C. (Elect.) or equivalent.

Applications stating experience, age and present salary, etc., to the

Personnel Officer**Dock Road, Bromborough, Cheshire**

7502

THE ZENITH ELECTRIC CO. LTD.
ZENITH WORKS, VILLIERS ROAD, LONDON, N.W.2

Invite applications for the positions mentioned below. Salaries will be commensurate with experience gained in each sphere and age need not necessarily deter application provided the ability to satisfy our requirements can be proved. We are a compact unit and service with us will provide variable experience.

DESIGNERS to cover single phase and three phase TRANSFORMERS up to approximately 45 kVa. Ability to handle chokes, rheostats and potentiometers would make these positions interesting.

TEST ROOM Person to take charge of Transformers, including the well known "VARIAC", Chokes and small equipments. This position is suitable for the maturer person with initiative and tact who seeks a post with varied testing.

DRAUGHTSMAN Senior electro mechanical design draughtsman with experience in the field of small electrical equipments and transformers.

All the above are staff positions and would qualify for our pension scheme. The usual five day week operates. Apply in writing to the above address or telephone Willesden 6581, Etn. 7, for an appointment. 7391

CENTRAL ELECTRICITY GENERATING BOARD**Southern Division****GRADE 10 ENGINEER, MARCHWOOD GENERATING STATION**
(SEC/3.131).

The person appointed may be required to undertake shift operational work, control room duties, assist on maintenance work or perform general station duties. Previous experience of modern generating plant is desirable.

Applicants should have had a sound technical training and possess qualifications leading to corporate membership of an appropriate professional institution or hold equivalent qualifications.

Salary N.J.B. Scale 10, Grade L.10, £1,190-£1,325 p.a.

Special application forms, obtainable only from Divisional Secretary, 111, High Street, Portsmouth, should be returned by 13th February, 1961.

ASSISTANT ENGINEER (MAINTENANCE PLANNING OFFICE), MARCHWOOD GENERATING STATION
(SEC/3.132).

Applications are invited from suitably qualified and experienced engineers to take charge of the Maintenance Planning Office under the Maintenance Superintendent. The duties include the planning of the day-to-day maintenance and co-ordination of the work of the mechanical, electrical, instrument and building maintenance sections. The successful candidate will be responsible for the implementation of routine maintenance and assisting with the detailed planning and programming of major plant overhauls.

Salary N.J.B. Scale 11, Grade L.9, £1,275-£1,410 p.a.

Special application forms, obtainable only from Divisional Secretary, 111, High Street, Portsmouth, should be returned by 15th February, 1961.

SHIFT CONTROL ENGINEER, EARLEY GENERATING STATION
(SEC/3.133).

Applicants should have had appropriate experience in a modern generating station with high operating temperatures and pressures. Manufacturing works experience will be an advantage.

Preference will be given to those possessing technical qualifications leading to corporate membership of a recognised professional engineering institution or those holding appropriate equivalent qualifications.

Salary N.J.B. Scale 6, Grade G.10, £890-£1,015 p.a.

Special application forms, obtainable only from P. D. A. Oliver, Divisional Secretary, 111, High Street, Portsmouth, should be returned by 15th February, 1961. 7581

MANAGERIAL EXECUTIVE (SALES)

A LARGE Manchester company prominent in both home and overseas markets in the manufacture of a wide range of electrical insulating materials, including plastic laminates, invites applications for the position of **MANAGERIAL EXECUTIVE (Sales)**.

Applicants should be between 30 and 40 years of age and should preferably be technically qualified and trained engineers with a broad knowledge of electrical plant and the usage of electrical insulators. Experience in sales management and commercial work would be an additional advantage. The position is an interesting one and demands keen intelligence, organising ability and a lively personality. The prospects of advancement and conditions of service are good, and commencing salary within the range £1,500-£2,000 is envisaged.

Apply giving details of education, qualifications, experience and present salary to the Chief Personnel Manager.—Box 7571.

PIONEER ELECTRIC CANADA

SENIOR TRANSFORMER DESIGN ENGINEER wanted. Minimum education H.N.C. in Electrical Engineering. Minimum experience 10 years in design of 5-kVA to 50-MVA transformers.

SWITCHGEAR DESIGN ENGINEER wanted. Minimum education H.N.C. in Electrical Engineering. Minimum experience 5 years or more in design of metalclad and metal-enclosed switchgear up to 15 kV, with some knowledge of high-voltage circuit breakers preferred.

Pleasing personalities and energetic attitudes essential. Positions of particular interest to young engineers desiring to join a new and rapidly expanding organisation where working conditions and job opportunities are good.

Attractive salaries, depending upon qualifications.

Full details re education and experience to:—

PIONEER ELECTRIC LIMITED
1, Rockwood Place, Winnipeg, 9
Manitoba, Canada

7264

Situations Vacant (continued)

AIR MINISTRY

STATION ENGINEERS (G.D.) and **STATION ENGINEERS (Mech.)** required at R.A.F. and Ministry of Aviation stations throughout the United Kingdom. The work of Station Engineers (G.D.) consists of installation, operation and maintenance of high and medium-voltage electrical distribution systems, electrical power and lighting installations, control systems and generating plant; knowledge of heating and ventilating plant and diesel engines an advantage. Station Engineers (Mech.) are concerned with diesel power plant, steam and hot water heating systems, refrigeration and air conditioning and miscellaneous workshop plant, tools and equipment.

Candidates should hold O.N.C. Elec. or Mech./C. and G. Electrical Technicians Certificates/2nd Class M.O.T. Certificate or equivalent, and must also have had recognised apprenticeship with firm of good repute plus 3 years' employment in electrical or mechanical and engineering, preferably on operation and maintenance of mine, factory or workshops plant and services. Preference to candidates with supervisory experience.

Commencing salary, which is dependent upon age, qualifications and experience, ranges from £745 (age 25) to £925 max. in Grade III. There are pension prospects and also opportunities of advancement to numerous posts in the higher grades vacancies which, as a rule, are filled by promotion of Grade III staff, viz.:—

Technical Grade II	£925-£1,055
(276 posts)	
Inspector of Works Grade I	£1,055-£1,295
(137 posts)	
Technical Grade B	£1,295-£1,491
(25 posts)	
Technical Grade A	£1,385-£1,630
(17 posts)	

Overseas tours for which special allowances ranging at present up to £1,800 p.a. are payable in addition to a higher salary. Internal training courses are provided and financial assistance and time off is allowed for recognised courses of study leading to higher qualifications. 5-day week with 18 days' paid leave a year initially.

Applicants, who must be natural-born British subjects, up to age 55, should write stating age, qualifications and experience to the Manager (P.E.1), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. No original testimonials should be sent. Candidates selected will normally be interviewed in London and certain expenses reimbursed. Only applicants selected for interview will be advised. 249

SOUTH OF SCOTLAND
ELECTRICITY BOARD

Lanarkshire Area

APPOINTMENT OF
THIRD ASSISTANT ENGINEER
(CONSTRUCTION)

APPPLICATIONS are invited for the appointment of **THIRD ASSISTANT ENGINEER** in the Area Construction Engineer's Department.

Candidates should have had a sound engineering training and preferably hold technical qualifications leading to Corporate Membership of the I.E.E. The successful applicant will require to assist the Construction Engineer in the preparation of switchgear and other schedules, checking switchgear and protection drawings, and the supervision of the erection of 33 and 11-kV switchgear at site.

The salary and conditions of service will be in accordance with the National Joint Board Agreement. Present classification and grading is L.10 (Scale 10), present salary £1,190/£1,325. It is a condition of this appointment that the successful candidate will reside within a reasonable distance of the Lanarkshire Area Offices at Hamilton.

Application forms, which may be had from the undersigned, should be forwarded to this office, within 14 days of the date of this advertisement.

R. J. RENNIE,
Manager.

Montrose Crescent,
Hamilton. 7540

Associated Electrical Industries Limited
Turbine-Generator Division, Manchester**ELECTRICAL and
MECHANICAL ENGINEERS
and DRAUGHTSMEN**

Associated Electrical Industries, Turbine-Generator Division, have vacancies at Trafford Park for experienced **ELECTRICAL** and **MECHANICAL ENGINEERS** and **DRAUGHTSMEN** for the investigation of special features associated with the development of large high speed turbo-type generators.

There are also vacancies for engineers and draughtsmen with some experience in the design of rotating electrical machines.

Please write for application form, quoting reference C.18 to:—

Personnel Manager
Associated Electrical Industries (Manchester) Ltd.
Trafford Park, Manchester, 17

7457

WAR OFFICE

requires

Assistant Mechanical and Electrical Engineers
at R.E.M.E. Workshops, Aldershot.

ASSISTANT MECHANICAL ENGINEER: Take charge of repairs, service mechanical and electrical equipments, vehicles and armaments. **Quals.:** recognised engineering apprenticeship and A.M.I.Mech.E. or equiv. **Min. 3 years'** executive experience in workshop dealing with batch or jobbing work and knowledge of army organisation and equipment and modern management techniques with particular reference to progressing and time costing. (Ref. C.66/1/A.)

ASSISTANT ELECTRICAL ENGINEER: Control all work connected with overhaul and repair of electrical and mechanical work associated with repair of wireless, line, electro-medical and optical equipments, including organisation of all activities concerning efficient functioning of a test equipment standards room. **Quals.:** recognised electrical engineering apprenticeship and A.M.I.E.E. or equiv. **Min. 3 years'** executive experience in a workshop dealing with repair of precision electro-equipments having an electronic basis; sound knowledge of service telecommunications and fire control equipments. (Ref. D.40/1/A.)

Salary £780 (age 25) to £1,220. Opportunities for establishment.

Forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting appropriate reference. Closing date, 20th February, 1961. 7547

ELECTRICAL ENGINEERS

Salary Scale £910 × £35(1) × £40(2)
× £45(5) × £50(7) to £1,600 p.a.

APPPLICANTS should be Corporate or Graduate Members of the Institution of Electrical Engineers, and have a wide experience in design, estimating and preparation of specifications and schedules to cover all types of electrical installation work, including power, lighting, heating, lifts, call systems, telephones.

Graduate I.E.E.'s enter at minimum of salary scale and their maximum salary will be £1,205 until Corporate membership is attained. Corporate members can be considered for a starting salary between £1,160 and £1,300 depending on experience.

Applications stating age, qualifications, experience, present and previous appointments and the names of three referees, should be forwarded to the Secretary, Western Regional Hospital Board, 351, Sauchiehall Street, Glasgow, C.2. 7487

SOUTH WESTERN ELECTRICITY BOARD

APPPLICATIONS are invited for the following positions:—

THIRD ASSISTANT ENGINEER (Planning), BRISTOL GROUP.

Salary according to Class L, Grade 9, Salary Scale 11, £1,275 to £1,410 per annum, of the N.J.B. Agreement.

The successful candidate will work in the technical and planning section and will be largely concerned with the detailed specification of 33 kV plant, and co-ordination and progressing of plant technical requirements. He will also assist in the commissioning of 33 kV substations.

Candidates should have had a broad technical training and experience of construction and operation of systems up to and including 33 kV with particular reference to 33 kV substation plant and protection. Transformer and switchgear manufacturers' experience would be an advantage. Corporate Membership of the Institution of Electrical Engineers or an equivalent technical qualification is desirable.

Applications to be made on Standard Form AE6/ACT OBTAINABLE BY POSTCARD ONLY from the Group Administrative Officer, South Western Electricity Board, Electricity House, Colston Avenue, Bristol, 1. Closing date for receipt of completed applications is 18th February, 1961.

FOURTH ASSISTANT DISTRICT ENGINEER, BRISTOL.

Salary according to Class K, Grade 12, Salary Scale 7, £965 to £1,090 per annum, of the N.J.B. Agreement.

The duties of this post may involve work on operation, maintenance and construction, protection or planning within the Bristol District.

Previous experience of operation, maintenance and construction on underground and overhead systems up to and including 33 kV is desirable. It would be an advantage if candidates have worked in urban areas and carried out switching operations on city networks. The successful candidate may be required to undertake standby duty on a rota basis.

Possession of the Higher National Certificate in Electrical Engineering and the ability to drive a car will be an advantage.

Applications to be made on Standard Form AE6/ACT OBTAINABLE BY POSTCARD ONLY from the District Manager, South Western Electricity Board, Electricity House, Colston Avenue, Bristol, 1. Closing date for receipt of completed applications is 18th February, 1961. 7578

EAST ANGLIAN REGIONAL HOSPITAL BOARD

Regional Engineer's Department

(1) ENGINEERING MAIN GRADE (Mechanical).

- (a) Corporate Members Inst. Mech. E. Salary £1,160-£1,600.
- (b) Corporate Members Inst. H. and V. E. Salary £910-£1,400.
- (c) Graduate Members Inst. Mech. E. Salary £910-£1,205.

(2) ENGINEERING MAIN GRADE (Electrical).

Graduate Members Inst. E. E. Salary £910-£1,205.

Candidates appointed will be engaged on design of central heating and hot water systems, air conditioning equipment, etc., including design of steam boiler plant, laundry installations, etc., or electric lighting and power installations, radio and telephone installations and electronics in relation to hospital engineering projects. Experience in estimating and in preparation of specifications desirable.

Candidates appointed under I (a) or I (b) will be responsible for small design team for all aspects of mechanical engineering services in large hospital building projects.

Graduate Members of the Institutions of Mechanical and Electrical Engineers automatically proceed by increments to maximum of Grade (£1,600) upon being admitted to corporate membership.

(3) ENGINEERING DRAUGHTSMEN

- (Mechanical and Electrical).
- Grade I, salary £1,030-£1,250.
- Grade II, salary £870-£1,010.
- Grade III, salary £550-£850.

Candidates for I and II should preferably have H.N.C. or O.N.C. and be experienced in the design of engineering works and the preparation of tender drawings and specifications under supervision.

Candidates for III should have had minimum of 3 years' practical training including site or workshop experience. Knowledge of engineering drawing and estimating an advantage.

Applications stating age, qualifications, experience and details of present position with names of three referees to Secretary of Board, 117, Chesterton Road, Cambridge, by 3rd March, 1961.

7554

REQUIRED BY CONSULTING ENGINEERS

JUNIOR CONTRACT ENGINEERS

to assist in the handling and administration of contracts for electrical equipment, principally associated with transmission and distribution.

Minimum qualifications: recognised apprenticeship, H.N.C., and two years' experience similar work.

Salary in accordance with qualifications and experience. Pension and bonus scheme. Five-day week.

Apply in writing, stating age and experience, not later than the 14th February, 1961, to Preece, Cardew & Rider, 8, 10 & 12, Queen Anne's Gate, Westminster, London, S.W.1.

7529

PRODUCTION MANAGER

WELL-known manufacturers of small electrical equipment in South of England, employing 150/200, require ENGINEER age 30 to 40 to take charge of production with a view to ultimate position as Works Manager. Production engineering and light engineering machine shop experience essential. Electrical background and technical or production certificates desirable. Generous salary and good prospects.

Replies stating qualifications and salary expected.—Box 7380.

SOUTHERN ELECTRICITY BOARD

Assistant Planning Engineer (Mains)

Sub-Area Engineering Department of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class M, Grade 7 (£1,535-£1,720 per annum). N.J.B. conditions of service.

The duties of the post will be to assist the Sub-Area Planning Engineer with the preparation and examination of H.V. and L.V. schemes for the development and reinforcement of new and existing systems operating at voltages of 33 kV and below, and with the design and specification of underground and overhead mains for such systems. The applicant must be well qualified, both technically and by experience, and be fully acquainted with all statutory requirements.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks., and returned to him, quoting Z.1307, not later than 13th February, 1961.

Fourth Assistant Engineer (Meters)

Sub-Area Engineering Department of No. 1 (Southall) Sub-Area, located at Waterloo Road, Uxbridge. Salary N.J.B. Class M, Grade 13 (£1,090-£1,215 per annum, including London allowance). N.J.B. conditions of service.

Applicants must have had experience in a Class A meter testing station and must be capable of supervising and co-ordinating the testing work in the department.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.1306, not later than 13th February, 1961.

Demonstrator

Reading District of No. 2 (Newbury) Sub-Area. Salary N.J.C. Grade I (£600-£700 per annum). N.J.C. conditions of service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent domestic science qualification would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks., and returned to him, quoting Z.1309, not later than 13th February, 1961.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

7590

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

Littlebrook Power Station

ASSISTANT ENGINEER (Shift Operation) (Vacancy No. 33/61).

The successful applicant will be responsible to the Assistant Shift Charge Engineers in the A, B or C stations for the shift work duties relating to boiler and turbine operation in the stations, with emphasis on efficient boiler house working.

H.N.C., electrical or mechanical, or equivalent qualification is preferred, and some knowledge of control room work would be an advantage.

Salary within N.J.B. L.10, £1,240-£1,375 per annum, including London allowance.

Applications giving age, details of experience, qualifications, etc., should be sent to the Station Superintendent, Littlebrook Power Station, near Dartford, Kent, to arrive by 14th February.

W. H. DUNKLEY,
Divisional Controller.

7557

CABLE EXPORTS

Senior Appointment

INTERNATIONALLY known United Kingdom power cable manufacturer will shortly make a senior appointment to its Export Sales Department.

Candidates are required to have a successful sales record, not necessarily overseas, and to have reached a sound technical standard as regards electricity distribution and transmission.

Domicile London, but tours overseas will be made.

Replies must give full details and will be treated in the strictest confidence. Reply to Director (Export).—Box 7505.

SOUTH EASTERN ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER (Construction). Salary £1,440-£1,610 per annum under N.J.B. Schedule B, Grade AX5. Superannuable. The duties attaching to this position require an experienced engineer, preferably a Corporate or Graduate Member of the Institution of Electrical Engineers. The person appointed will be required to assist in the design and construction of substations up to 33 kV, and the preparation of specifications for plant and materials, including underground cable works and overhead lines. His duties will also embrace plant inspection and associated engineering problems whilst maintaining close liaison with the field engineers. Applications quoting ER and naming two referees on forms from the Engineer-in-Chief, SEEBOARD, 10, Queen's Gardens, Hove, 3, Sussex, by 15th February, 1961.

SECOND ASSISTANT ENGINEER (Construction), CROYDON and WEST KENT HEADQUARTERS. Salary under N.J.B. Class K, Grade 7, £1,400 × £30 to £1,550 p.a. including London allowance. Superannuable. Candidates should be either Corporate or Graduate Members of the Institution of Electrical Engineers and have a wide experience in the construction and commissioning of substations, overhead and underground distribution systems up to and including 33 kV. Applications quoting ER and naming two referees on forms from the Croydon and West Kent Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, Surrey, by 15th February, 1961.

CARTOGRAPHIC DRAUGHTSMAN, CROYDON and PURLEY DISTRICT. Salary £740 × £25 to £815 per annum including London allowance under N.J.C. Grade 2. Superannuable. Applicants should have a good general education, experience in a distribution drawing office, and be fully conversant with mains recording and preparation of system diagrams, etc. Applications quoting ER and naming two referees on forms from District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 15th February, 1961.

GEORGE WRAY,
Secretary.
7587

CENTRAL ELECTRICITY GENERATING BOARD

Southern, South Western and South Wales Region

Research and Development Department

ELECTRICAL ENGINEERS

Regional Vacancy No. 108

APPLICATIONS are invited for two posts based at new laboratories at Portishead 10 miles west of Bristol. The work involves laboratory and site investigations of technical problems occurring on the Board's generation and transmission systems and requires an original outlook and the ability to apply fundamental principles.

Applicants should be experienced in one or more of the following fields: power generation, power transmission, electronic design, electrochemical corrosion investigations, acoustic measurements. Research experience is desirable. Applicants should preferably hold qualifications leading to corporate membership of a senior professional institution, although H.N.C. or equivalent may be acceptable.

The salaries for the posts will be within the range £1,115-£1,410.

Successful candidates can be assured of excellent career prospects, based entirely on merit, and of being engaged on forward looking work. Staff are given every facility to publish technical and scientific papers. Assistance may, under certain conditions, be given with housing.

Applications on Forms AE6/ACT, obtainable from the Regional Secretary, Central Electricity Generating Board, Southern, South Western and South Wales Region, 1, Eaton Crescent, Clifton, Bristol, 8, should be returned so as to reach him by not later than Monday, 13th February, 1961.

7555

Situations Vacant (continued)**CENTRAL ELECTRICITY
GENERATING BOARD****Assistant Engineers**

required in the System Design and Development Section of the Transmission Department at Headquarters, London, S.E.1.

Successful candidates will be required for duties on:—

- Programming work on, and the operation of, A.C. network analysers.
- General analysis problems on the Board's transmission network.
- General system studies in connection with direct current transmission and the operation of a direct current transmission simulator.
- Calculation and classification of power system data and its organisation for use with analogue and digital computer programmes in system analysis.

Candidates should have a sound technical training, and previous experience in the operation of network analysers and/or the problems connected with power system analysis. They should possess a recognised qualification in electrical engineering. A university degree would be an advantage.

Salaries on a scale within the range £1,345-£2,010 per annum according to duties and responsibilities.

Applications stating age, qualifications, experience, present position and salary to the Appointments Officer, 24/30, Holborn, London, E.C.1, by 20th February. Envelopes should be marked "Confidential Ref. ER/37."

7521

LONDON COUNTY COUNCIL

South-East London Technical College,
Lewisham Way, London, S.E.4

Department of Electrical Engineering

APPLICATIONS are invited for posts as LECTURERS and ASSISTANT LECTURERS (Grade B) in Telecommunications and/or Light Current Electrical Engineering. Candidates should be well qualified, have industrial experience and preferably some teaching experience.

The department offers full-time, sandwich, part-time day and evening courses. The successful candidate should be able to teach up to Part III I.E.E. and/or C. & G. Telecommunications supplementary studies standard respectively.

Salary scales:—

- LECTURERS, £1,408 to £1,601, with possible entry above the minimum.
- ASSISTANT LECTURERS (Grade B), appointment within scale £738 to £1,201 with additions as approved to a possible maximum of £1,486 for degree, good honours and suitable full-time study on research.

Point of entry and maximum dependent on relevant industrial or teaching experience and qualifications.

Application forms from the Secretary, returnable within two weeks. Please quote reference FE.3a/R/224/2.

7546

**CENTRAL ELECTRICITY
GENERATING BOARD****Southern Division****ASSISTANT SHIFT CHARGE
ENGINEER, PORTSMOUTH
GENERATING STATION
(SEC/3.129).**

Applicants should have had previous experience in a modern generating station, and manufacturing works experience will be an advantage. Preference will be given to those who either possess qualifications and experience leading to corporate membership of a recognised professional institution, or who are studying for the examinations of such an institution. The successful candidate may be required to undertake duties in either the boiler house or turbine room.

Salary N.J.B. Scale 8, Grade H.9, £1,040-£1,165 per annum.

Special application forms, obtainable only from Divisional Secretary, 111, High Street, Portsmouth, should be returned by 13th February, 1961.

7558

**METROPOLITAN POLICE
ENGINEERING DEPARTMENT****TECHNICAL OFFICERS GRADE III
required for:—**

- Heating, Ventilating, Air Conditioning, Panel Warming and Oil-fired Installations.
- Electrical Engineering Installations and Maintenance, including Lift Maintenance.

Minimum qualification O.N.C. or equivalent. Salary £852-£1,014 per annum. Maximum starting p.y at age 28, £909.

Five-day week. 18 days' paid holiday a year. Generous sick leave. Non-contributory superannuation scheme.

Written applications with full personal particulars to Chief Clerk, Engineering Dept., New Scotland Yard, London, S.W.1.

7503

GOVERNMENT OF QATAR**STATE ELECTRICITY DEPARTMENT**

THE Government of Qatar in the Arabian Gulf has a vacancy for a POWER HOUSE MAINTENANCE ENGINEER in the State Electricity Department.

There are two existing power stations: (No. 1) comprising 7 diesel alternator sets of 200-540 kW; (No. 2) comprising 5 diesel alternator sets of 2,600 kW. A new steam power station with an initial installation of 2-15,000 kW turbo-alternator sets is under construction.

Applicants between 40-45 years of age must have served a mechanical engineering apprenticeship and have studied up to the Higher National Certificate and have had considerable experience of the erection, operation and maintenance of diesel-engine alternator sets up to 4,500 b.h.p. and all ancillary equipments with experience in a modern diesel power station and its associated problems. Similar experience with modern steam plant is also desirable.

Appointee may be required to deputise for power station superintendent during his absence on leave or illness.

Salary starting at Rs. 2,000 per Arabic month (equivalent to approximately £1,950 per year) with annual increments of Rs. 100 per month up to a maximum salary of Rs. 2,300 per month.

Contract offered is for three or five years subject to six months probationary period. Gratuity payable on completion of contract. Leave: 6 days for each month on duty, taken annually. Free passages, furnished accommodation, fuel, light, water and medical treatment. No income tax.

Applications endorsed "Power House Maintenance Engineer, Qatar," accompanied by full personal particulars including age, education, qualifications, experience, religion and past employment, the names of three referees and a recent dated photograph should be made in writing, in duplicate, within 14 days of the date of this advertisement, to:—

PREECE, CARDEW & RIDER

8-12, Queen Anne's Gate,
Westminster, S.W.1.

7586

SOUTH WALES SWITCHGEAR LIMITED

APPLICATIONS are invited for the post of TECHNICAL SALES REPRESENTATIVE. Switchgear training and qualifications to H.N.C. essential. Must hold current driving licence. Successful applicant will be based at Wilslow.

Apply stating age, qualifications, experience and salary required to—The Home Sales Manager, South Wales Switchgear Ltd., Rex Buildings, Wilslow, Cheshire, and mark the envelope "Confidential."

7574

**CENTRAL ELECTRICITY
GENERATING BOARD****Eastern Division**

APPLICATIONS are invited for the following appointments at West Thurrock Generating Station (Essex):—

MAINTENANCE ENGINEER (Electrical)
(S.V. No. 1432).

MAINTENANCE ENGINEER (Mechanical)
(S.V. No. 1433).

Salaries N.J.B. Class M, Grade 6, Scale 15, £1,650-£1,830 plus London weighting.

Applicants should have had wide practical experience in electrical or mechanical maintenance at modern generating stations and should preferably be Corporate Members of the Institution of Electrical or Mechanical Engineers.

Experience in the field of labour relations and modern management techniques would be an advantage.

Applications, quoting the appropriate Reference S.V. No., stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., by 11th February, 1961.

7530

**CENTRAL ELECTRICITY
GENERATING BOARD****South Wales Division****Re-Advertisement**

Vacancy No. 24/ER/61

APPLICATIONS invited for the superannuable N.J.B. appointment of STATION SHIFT CONTROL ENGINEER at LLYNFI POWER STATION, Near Bridgend, Glam.

Salary Schedule A, Class G, Grade 10, Scale 6 (£890-£1,015 per annum), plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent qualifications and have had experience in a modern power station.

Previous applicants need not re-apply.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabaalfa, Cardiff, to be returned by 13th February, 1961.

7580

NORTH EASTERN ELECTRICITY BOARD**Wear Sub-Area**

APPLICATIONS are invited for the appointment of DISTRICT COMMERCIAL ENGINEER, CONSETT DISTRICT, with location at Stanley Service Centre.

Applicants should be suitably qualified engineers and have experience in the utilisation of electrical energy in commercial and domestic premises, knowledge of installation work and be conversant with tariffs, sales and all aspects of consumer service.

Duties of the post include responsibility for commercial administration of the district, control of two service centres, contracting and consumer service arrangements.

Salary Schedule A, Class F, Grade 3, i.e. £1,350/£1,500 per annum. N.J.B. conditions of employment.

Applications stating age, qualifications and experience to be received by the Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carlisle House, Newcastle upon Tyne, 1, within ten days of the appearance of this advertisement.

7576

DEPUTY ENGINEER

required for Ghana by leading British merchant's house. To be fully qualified electrical engineer with commercial and practical experience overseas in a wide range of electrical equipment and to act as deputy to Ghana engineering manager. Preferably under 36 years of age. Commencing salary £1,500/£1,800 depending upon experience, plus commission, free partly-furnished accommodation, provident fund, etc. Full personal particulars and experience, to—Box 7429.

CENTRAL ELECTRICITY
GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointments at West Thurrock Generating Station (Essex):—

SHIFT CHARGE ENGINEERS
(S.V. No. 1434).

Salaries N.J.B. Class M, Grade 6, Scale 15, £1,650-£1,830 plus London weighting, plus 10% shift allowance.

Applicants should have had wide operating experience in modern generating stations and should preferably be corporate members of one or more of the recognised engineering institutions.

Experience in the field of labour relations and modern management techniques would be an advantage.

Applications, quoting Reference S.V. No. 1434, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., by 11th February, 1961. 7531

SOUTH OF SCOTLAND
ELECTRICITY BOARD

APPLICATIONS are invited for a superannuable position as a PLANT SHIFT CONTROL ENGINEER at KINCARDINE GENERATING STATION.

Applicants should have experience of station control room duties in a modern generating station and possess qualifications of Higher National Certificate standard or equivalent. The duties will include operation and supervision of all control equipment associated with main plant.

Salary N.J.B. Class K, Grade 10, £1,115/£1,245, rising ultimately to Class M, Grade 10, £1,275-£1,410 (plus shift allowance of 10% per annum).

Housing accommodation may be made available if required.

Applications, on the standard form and quoting reference No. G2/61, should be submitted to the Secretary, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4, not later than 17th February, 1961. 7537

HONG KONG

A LARGE North American company operating in the Far East requires OVERHEAD LINE ENGINEER for sales development work on aluminium overhead conductors. Successful applicant will reside in Hong Kong but will be required to travel extensively throughout the Far East.

Applicants must hold University Degree or equivalent qualification in electrical engineering and have minimum five years' experience in transmission and distribution line design and erection. Previous overseas experience an advantage. Age limit 28-35, but relaxable in special cases.

Salary commensurate with age and experience, but not less than £2,250 per annum. Unfurnished accommodation available at "nominal" rental. Medical benefits. Six months' home leave after 3 years' service with return air passages paid by company. Pension scheme.

Write giving full details of age, experience and qualifications to Box F.207, c/o Streets, 110, Old Broad Street, London, E.C.2. 7447

MINISTRY OF AVIATION

require ELECTRICAL ENGINEERS as Assistant Signals Officers. Posts mainly in London, but some in Provinces.

Duties include planning, evaluation, installation and supervision of operation and maintenance of civil aviation telecommunications and navigational aids at airports and telecommunication centres.

Quals.: 1st or 2nd class Hons. Degree in Physics or Engineering, A.M.I.E.E. or A.F.R.Ae.S. Candidates with Parts I, II and III of A.M.I.E.E., or Parts I and II of A.F.R.Ae.S. or equiv., or of high professional attainment without these quals. considered.

Salary scale: £690 (at age 23) to £1,300. Slightly lower for posts outside London. Promotion prospects.

Further details and forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.161/OA. 7559

TELEPHONE TECHNICIANS:
OVERSEAS/U.K. SERVICE

CABLE AND WIRELESS Limited require TELEPHONE TECHNICIANS for service at some overseas branches.

Duties include supervision of construction of external lines (overhead and underground) and installation of subscribers' station apparatus, planning of subscribers' networks, and ordering of materials.

Applicants, aged 20/30, must hold a minimum of 5 "O" level passes in G.C.E., including English, Mathematics and Physics, or appropriate C. and G. certificates. Preference given to those with knowledge of Strowger type exchanges and multi-channel carrier line systems. Full information, including pay and allowances, will be given at interview.

There is also an administrative vacancy for an ASSISTANT ENGINEER with similar background in the company's head office in London.

Write giving details of qualifications and experience to Staff Manager, Cable and Wireless Limited, Mercury House, Theobalds Road London, W.C.1. 7471

CENTRAL ELECTRICITY
GENERATING BOARD

London Division

APPLICATIONS are invited for the following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER
(ELECTRICAL TEST),
FULHAM POWER STATION
(Vacancy No. 61/63).

Sound technical training with knowledge of testing and routine maintenance of power station electrical equipment, including generators, switchgear, transformers, motors and protective equipment. Salary Class K, Grade 15, £815-£920 per annum.

Applications, quoting vacancy number, may be made to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box No. 136, London, W.1, to be received not later than 14th February, 1961. 7535

CITY OF SALFORD

Baths and Laundries Department

APPOINTMENT OF MANAGER OF A
PUBLIC LAUNDRY

APPLICATIONS are invited for the appointment of RESIDENT MANAGER of the new All-Electric Public Laundry, Pendleton, Salford, 6.

Salary £685/£760 per annum, less £50 per annum in respect of house, heating and lighting.

Candidates should have suitable electrical and mechanical engineering qualifications and practical managerial experience in the control of a modern public laundry.

Conditions and duties of appointment from the General Superintendent, Blackfriars Road Baths, Salford, 3, to whom applications endorsed "Resident Laundry Manager," stating age, qualifications and experience, together with two recent testimonials, should be sent by Saturday, 11th February, 1961. 7513

DIESEL MECHANIC FOR ANTARCTICA

DIESEL MECHANIC urgently required by Falkland Islands Dependencies Survey, for service in the Antarctic for two years. Salary is at basic rate of £500 a year. Whilst in Antarctic everything is provided free, including clothing, cigarettes, etc. Generous cash payment on completion of service.

Candidates, between 20 and 30 years of age and preferably single, must be capable of maintaining small petrol or diesel generating plant and be able to instal and maintain elementary electrical circuits.

Successful candidate will be required to leave immediately.

Apply to Crown Agents, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2a/50974/EF. 7544

PORT OF MANCHESTER

Electrical Assistant

THE MANCHESTER SHIP CANAL COMPANY have a vacancy for an ELECTRICAL ASSISTANT in the Mechanical Engineer's Department.

Applications for the position are invited from candidates, who should be not more than 40 years of age, with either a University Degree or Corporate Membership of the Institution of Electrical Engineers and with experience in the design, layout and maintenance of electrical equipment appertaining to dock and railway undertakings. The successful candidate will be required to pass a medical examination and to become a member of the company's contributory superannuation scheme.

Applications, containing full particulars of age, education, qualifications, experience and salary envisaged, should be addressed to the Mechanical Engineer, Manchester Ship Canal Company, Ship Canal House, King Street, Manchester, 2. Envelopes should be marked "E.A. PERSONAL." 7536

THE POLYTECHNIC

309, Regent Street, London, W.1

Department of Electrical Engineering

VACANCIES exist for TWO FULL-TIME TEACHERS to join the Department on 1st May, 1961. They should be qualified to lecture to students preparing for the B.Sc. (Eng.) Degree or the Diploma in Technology, and should preferably have had recent industrial experience.

The salary scale for the senior appointment commences at £1,370 and rises to £1,550 per annum, plus London allowance of £38 or £51, and for the second post has a maximum of £1,240, plus London allowance, and possibly additional allowance for training and a good honours degree.

A form of application, which should be returned not later than 4th March next, may be obtained from the undersigned.

J. E. RICHARDSON,
Director of Education.

7532

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

SENIOR SERVICE CENTRE ASSISTANT, HILLSBOROUGH SERVICE CENTRE.

Applicants must have had previous experience in Service Centre work including the sale of electrical appliances, hire purchase agreements, handling of enquiries, taking accounts; and must be capable of advising consumers on any matter relating to the use of electricity in their homes. A knowledge of display work would be an advantage. The successful candidate will be in charge of the Service Centre, and responsible for the control of the staff.

Salary N.J.C. Grade 2, £700/£725/£775 per annum.

Applications giving full details of age, qualifications and experience should be sent to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, 1, not later than 17th February, 1961. 7589

CENTRAL ELECTRICITY
GENERATING BOARD

South Western Division

Vacancy No. ER/AV/15/61

THIRD ASSISTANT ENGINEERS (Control) required in the System Operation Department, Near Bristol.

Superannuation scheme. Salary N.J.B. Class BX, Grade 8, Scale 11, £1,105-£1,410 per annum, plus 10% shift allowance.

Applicants should have had a good general and technical education and preferably have attained at least H.N.C. standard. Experience in a steam power station will be an advantage.

Duties will cover switching, load despatching and general operation work in the Bristol Grid Area Control Room.

Applications on Form A.E.6/ACT obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 14th February, 1961. 7588

Situations Vacant (continued)**CENTRAL ELECTRICITY
GENERATING BOARD****Midlands Division**

MAINTENANCE ENGINEER (Electrical) is required at Nchells "A" and "B" Power Stations. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K.5, £1,535-£1,720 per annum.

A sound technical training and practical experience in electrical maintenance in a modern power station is required, and the possession of an appropriate technical qualification will be an advantage.

Apply, quoting Vacancy No. 21/61 MD, on form AE6, available from the Station Superintendent, Nchells Power Station, Aston Church Road, Nchells, Birmingham, 7, to whom they should be returned to arrive not later than 13th February, 1961.

7545

EASTERN ELECTRICITY BOARD**Essex Sub-Area****North Essex District****THIRD ASSISTANT ENGINEER**

14/61.R.

CANDIDATES should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, including substations.

Salary N.J.B. Class F, Grade 9 (£890-£1,015).

Living accommodation will be available.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Apply by letter to J. C. Horrell, M.I.E.E., Manager, North Essex District, Eastern Electricity Board, Cressing Road, Braintree, Essex, by 17th February, 1961.

7579

**CENTRAL ELECTRICITY
GENERATING BOARD****South Eastern Division****Northfleet Power Station**

Vacancy No. 32/61

GENERAL ASSISTANT ENGINEER required to assist the Efficiency Engineer with Plant Investigations, Records, etc. Possession of the H.N.C. would be an advantage.

Salary within the range £1,015-£1,140 per annum including London allowance.

Applications giving age, details of experience, qualifications, etc., should be sent to the Station Superintendent, Northfleet Power Station, Crete Hall Road, Northfleet, Kent, to arrive by 14th February.

W. H. DUNKLEY,
Divisional Controller.

7556

DESIGNER-DRAUGHTSMAN

required, North-West London area. Knowledge in electrical wiring accessories an advantage. Good opportunity for right man.

Apply stating age, experience and references.—Box 7511.

**MEASUREMENT AND EVALUATION
OF ELECTRICAL INSTALLATIONS**

A VACANCY occurs for a competent **ESTIMATOR AND MEASURING SURVEYOR** for interesting industrial installations.

Applications in writing in the first instance stating age, experience and salary required, etc., to FRANK N. FALKNER & PARTNERS, Chartered Quantity Surveyors, Windscale Works, Seascale, Cumberland.

7361

CABLE contracts engineers required with experience installations to at least 33 kV. Must be prepared travel anywhere in U.K. Apply, giving details of work carried out, to—Contracts Manager, Enfield-Standard Power Cables Ltd., Stockingswater Lane, Brimsdown, Middlesex (Tel. No. Howard 2711).

7509

A GENUINE opportunity for man of integrity and good business acumen. View directorship with well-established North-West electrical wholesalers.—Box C.53, Lee & Nightingale, Liverpool, 2.

7526

CONSULTING engineers have vacancy for a qualified assistant electrical engineer for work of varied and interesting nature. Please send full details to Messrs. Mackness & Shipley, Parliament Mansions, Abbey Orchard Street, London, S.W.1, quoting ref. P.1210 and marking envelope "Confidential."

7551

CONTRACTS engineer required by rapidly expanding organisation to supervise and control large industrial and commercial electrical installations. Applicants must have wide experience in electrical contracting. This position is superannuated and carries a good salary. Company car provided. Applications, in strict confidence, should be addressed to—Managing Director, Scull Electrical Ltd., Lumens House, William Street, Bristol, 3.

7524

DESIGN engineer required for interesting and extremely varied work on transformers, voltage regulators and their control systems. Minimum qualifications H.N.C. in Electrical Engineering and preferably 2 or 3 years' distribution transformer design experience. Salary commensurate with experience, but company expects to pay not less than £1,000 per annum. Assistance given with housing and removal expenses. Apply—Chief Engineer, Brentford Transformers Ltd., Manor Royal, Crawley.

7568

DRAUGHTSMAN required for preparation of wiring diagrams for medium/low-voltage switchboards and motor control circuits. Existing holiday arrangements honoured. Superannuation scheme in operation. Interviews by arrangement. Apply—Chief Draughtsman, Varilectric Limited, 10, Melon Road, Peckham, London, S.E.15.

7520

DRAUGHTSMEN and engineers of all grades required for consulting engineer's office, experienced in electrical, mechanical, heating or ventilating systems for large industrial and commercial projects. Excellent prospects for promotion. Write stating age, experience and salary required to—Owen & Simmonds, 55, Welbeck Street, London, W.1.

246

DRAUGHTSMEN, junior and senior, required for small firm manufacturing fuse and switch gear, London, Kilburn area. Write full details and salary required.—Box 7438.

ELECTRIC control gear engineer/draughtsman, experienced in circuitry for heating, ventilating and oil burner controls, required by consulting engineers. Candidates should have at least a Higher National Certificate or Grad. I.E.E. Apply stating qualifications and experience to—Kennedy & Donkin, 12, Caxton Street, London, S.W.1 (ref. FBT/WBH).

236

ELECTRIC motor repairs, capable and practical man fully experienced fractional and domestic motors, to take charge of small shop London district. Partnership available.—Box 7567.

ELECTRICAL contracts engineer required by Gwynnes Pumps Limited, Lincoln. Applicants should have experience of medium and high-voltage motors and control gear, and also be capable of estimating for and supervising installation work associated with pumping plant. The company has contributory pension and life assurance scheme. Apply in writing in first instance giving details of training, experience, age and salary required to—The Secretary, Gwynnes Pumps Limited, Wellington Foundry, Lincoln.

7533

ELECTRICAL consultants, London, W.1, require junior assistant. Experience in contracting or design of electrical installations in schools, offices, etc., required. Write in own handwriting stating experience and salary required.—Box 7553.

ELECTRICAL engineering assistant required with experience in preparing specifications for new electrical installations in buildings. Up to £950. Pensionable. Prospect of advancement. Up to £1,250 for those obtaining H.N.C. (Elec.) Form from Chief Engineer (GS/R/253/2), L.C.C. County Hall, S.E.1.

7570

ELECTRICAL firm with attractive retail showrooms and small contracting business of good standing requires capable electrician with high standards of service; N.W. London; able to drive. Good prospects for keen man prepared to train for responsible position. State age and details of career.—Box 5007.

ELECTRICAL engineer, preferably with small motor design experience, required by a progressive London firm of motor manufacturers.—Box 7454.

ELECTRICAL maintenance fitter required by Fulham Borough Council; 42-hour week, permanent pensionable post, sickness and holiday schemes. Wage rates in accordance with electrical contracting industry award, at present 6s. 6½d. an hour. Experience in maintenance of electric passenger lifts essential. Application forms obtainable from the Borough Engineer and Surveyor, Town Hall, Fulham, London, S.W.6.

7525

ELECTRICAL supervisor for large building firm. Must have first-class contracting experience; able to control labour and set out work. Good prospects. State experience and salary required. Write—Box ER.168, c/o Hanway House, Clark's Place, London, E.C.2.

7506

ELECTRICAL wholesalers invite applications from stores and clerical personnel with some knowledge of the trade, seeking a progressive position.—L.E.C., 92, Blackfriars Road, London, S.E.1.

7431

EXPANDING electrical wholesalers require order clerk for branch at a West Country resort. Previous trade experience essential. Good salary and excellent prospects for the right man.—Box 7507.

EXPERIENCED company secretary required by old-established, but progressive, electrical engineering company. Very good prospects for a man who is able and willing to accept responsibility. Excellent salary and profit sharing scheme. Applications stating full details of experience, age, etc., to—Box 7566.

FIELD engineer required with experience in overhead distribution (wood pole) line construction. Successful applicant would be required to supervise contracts in the South of England. Applications stating age and experience, to—Watcham's Ltd., Chiltern Court, St. Peter's Avenue, Caversham, Reading (Telephone No.: Reading 73321).

7572

JUNIOR technical assistants required for work in connection with H.V. electrification schemes. Possession of Ordinary National Certificate and apprenticeship in electrical or mechanical engineering desirable. Salary at 25 years £635 per annum, with annual increments to £835 per annum at age 32 years, plus London allowance of £20 per annum. Additional payment for Higher National Certificate. Superannuation scheme. Sick pay. Travelling facilities, etc. Applications to be submitted to—The Chief Mechanical and Electrical Engineer, British Railways, 22/25, Finsbury Square, London, E.C.2.

7542

INSMEN, all grades required for wood pole line construction in England and Wales. Applications stating age and experience, to—Watsham's Ltd., Chiltern Court, St. Peter's Avenue, Caversham, Reading (Telephone No.: Reading 73321).

7573

LONDON consulting engineer requires intermediate electrical engineer/draughtsman with experience of lighting and power installations. Applicants should state age, experience, qualifications and salary required.—Walter Bridges & Company, 37, Parliament Street, Westminster, London, S.W.1.

7430

MAINS foreman required in the Redditch/Bromsgrove District. Experience essential in the control and supervision of large numbers of personnel. Conditions of service and salary (£880 per annum, Grade 1, Schedule E) will be in accordance with the N.J.I.C. Agreement. Apply by letter, within 14 days, stating age, experience, present salary and position to District Manager, Midlands Electricity Board, Windsor Road, Redditch, Worcs.

7518

REPRESENTATIVE required by electrical wholesaler for North London and Northern Home Counties area. Experienced man with industrial bias preferred. Salary, commission and car allowance, also superannuation scheme. Write or telephone—Sales Manager, British Central Electrical Co. Ltd., 6, Rosebery Avenue, London, E.C.1 (TERminus 3666).

7569

SALES engineer required for Leicestershire, Northamptonshire and Eastern Counties by leading firm of motor and gearbox manufacturers. Excellent prospects.—Box 7453.

STORES clerk required by electrical contractors. Must be conversant with trade materials and prices. Duties will include the control of small stores. Good salary and pension scheme. Apply in writing only to—Iverson Electrical Ltd., 346-350, Kilburn High Road, London, N.W.6.

5009

SUPERVISING engineer required, preferably about 25/30, experienced in preparation of estimates and specifications for lighting, heating and water heating schemes. Able to advise clients and supervise works. Applicants must have a thorough knowledge of contracting with particular reference to domestic and commercial installations. Vehicle provided. Expanding company, Kensington (London) area. Give age, details of experience and salary required to—Box 7392.

TECHNICAL assistant required for high-voltage electrification schemes. Higher National Certificate in Electrical Engineering desirable. Experience of substation planning, layout of H.V. and L.V. equipment, telephone type supervisory control circuits, erection and testing an advantage. Superannuation scheme. Sick pay. Travelling facilities, etc. Salary £925/£1,000 p.a. plus £20 per annum London allowance. Applications to be submitted to—The Chief Mechanical and Electrical Engineer, British Railways, 22/25, Finsbury Square, London, E.C.2. 7543

TECHNICAL representative required, resident in Coventry, Birmingham or Wolverhampton districts, for sale of switchgear, instruments, power factor correction capacitors, trunking and crane collector gear.—Box 7514.

TECHNICAL writer required for the preparation of catalogue leaflets, data sheets, maintenance instructions, etc., for motor control gear products. Write giving details of age, experience and salary required to—Managing Director, E. N. Bray Ltd., Britannia Road, Waltham Cross, Herts. 7552

TRANSFORMER designer required with suitable qualifications and experience to cover various types of transformers up to 5 MVA. Salary range £900-£1,050 according to experience. Apply to—Chief Designer, London Transformer Products Ltd., Bridgend, Glam. 7508

TRANSFORMER designer. To lead and control design and drawing office. A person of wide experience coupled with ability and enthusiasm is required. The position carries commensurate salary and promising future. Apply in writing—Willesden Transformer Company Ltd., Manor Park Road, Harlesden, London, N.W.10. 309

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

EXPERIENCE COUNTS!

ELECTRICAL ENGINEER, 20 years manager to contractors, from enquiry to accounts, designing schemes, etc., wide personal connection with architects and consultants, wants change.—Box 5004.

ELECTRICAL engineer (27), H.N.C., student I.E.E., seeks permanent progressive position. Conversant with the design and scheming of electro-mech. control systems, etc. Basic electronics knowledge. Willing to travel. All replies answered.—Box 5005.

ENGINEER requires sales management, or senior sales post, with company supplying the electronics industry. Extensive connection with designers and buyers throughout London and Home Counties. Experience in design of metal fabrications, woodwork, plastics and packaging.—Box 7702.

VERSATILE technical sales representative (49) desires change. Experienced liaison work, cable, distribution, communications, radio, earth leakage, lighting. Willing to accept responsibility. Good record. Figures to prove good connections. Resident Suffolk. Car owner.—Box 5006.

ARTICLES FOR SALE

HOUSE SERVICE METERS

200 -240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.
221, City Road, London, E.C.1 37

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

Sale by Tender of Miscellaneous Plant

THE Board have for disposal and invite tenders for the purchase of one 500 kW, 6,600/460-230 v., 3 W, D.C. Rotary Converter with transformer and starting panel; one 500 kW, 4-cubicle, 6,600/460-230 v. steel bulb Mercury Rectifier with transformer, D.C. switchboard, contactor, etc.; one 50 v. and one 225 v. Battery Set complete with charging units.

Particulars as to where they may be inspected and forms of tender, on which offers must be submitted, may be obtained on application to the Manager, No. 4 Sub-Area, Merseyside and North Wales Electricity Board, Electricity House, Rhostyllen, Wrexham. Tenders must be returned in a sealed envelope, as provided, so as to arrive not later than noon on Wednesday, the 8th February, 1961.

The equipment is offered for sale without guarantee as to its condition, and the Board do not bind themselves to accept the highest or any tender and reserve the right to accept the whole or any part of any tender.

M. M. PARKER,
Secretary.

January, 1961. 7585

HIGH QUALITY FORKLIFT TRUCKS

COVENTRY CLIMAX, Petrol, 1,500 lb., 9' lift, £550.

CLARK, Petrol, 4,000 lb., 9' lift, £595.

CLARK, Petrol, 6,000 lb., 9' lift, £695.

CLIMAX, Petrol, 4,000 lb., 12' lift, £750.

CLIMAX, Diesel, 5,000 lb., 12' lift, £1,000.

STACATRUC, Diesel, 5,000 lb., 12' lift, £950.

LANSING BAGNALL, Electric, 2,300 lb., 10' lift, with charger, 1958 model, £1,000.

Full details on application for appointment to view.

SPEED ELECTRICS

Church Street, Basford, Nottingham
(Tel. 75716) 7519

MOTORS

NEW CROMPTON PARKINSON, from ½ h.p. to 80 h.p.; also 6,000 A.C. and D.C. reconditioned Motors and Starters.

IN STOCK HERE

B. E. WHITE

Brantwood Rd., Tottenham, London, N.17
Tel. EDMonton 4621-2 215

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd. London W4. 57

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish, vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. slotmeters and quarterlies. Reconditioned, guaranteed 2 years. Repairs and recalibrations.—Victor Electric Co., South View, Sweet Hill, Patcham, Brighton, Sussex. London agents, phone Downland 4682 (Surrey). 5001

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 55/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 2234/5/6). 169

ALTERNATORS for sale from 1,100 kVA at 750 r.p.m. down to ½ kVA. Single and three-phase. All voltages. More than 150 machines in stock. Automatic regulators and switchboards available.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1 (CLerkenwell 5512). 24

ALTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

AMERICAN type flush switches, 10 A.Q.M.B. Brand new at fraction makers' prices. 15-in. and 12-in. 440-v., 3-ph. fully enc. exhaust fan motors, brand new, £2 2s. 6d. and £1 10s. each.—Electronic Equipment Co., 113, Grays Inn Road, London, W.C.1 (CHA. 6085). 7565

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, underground, all types ex stock.—E. M. Tatton & Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 117

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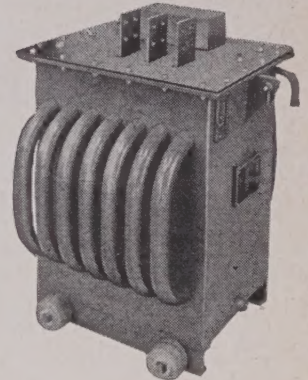
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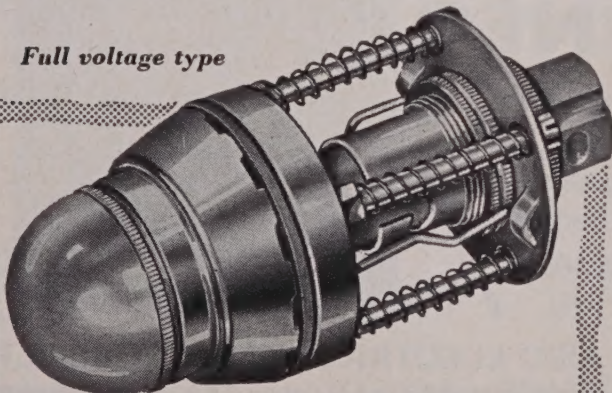
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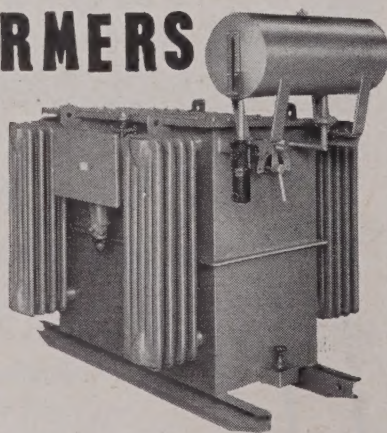
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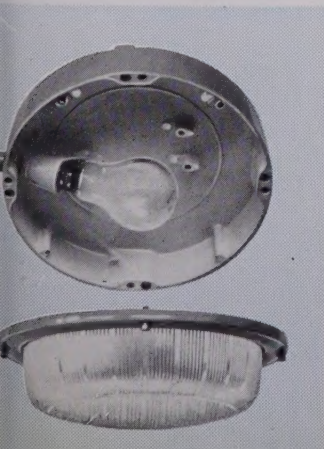
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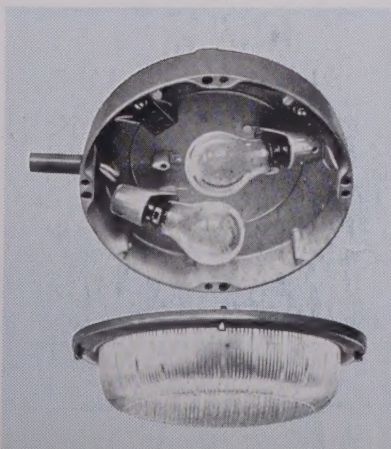


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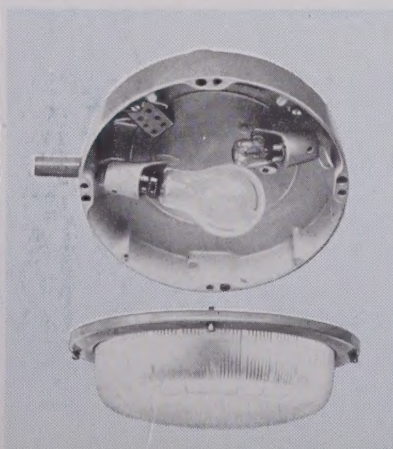
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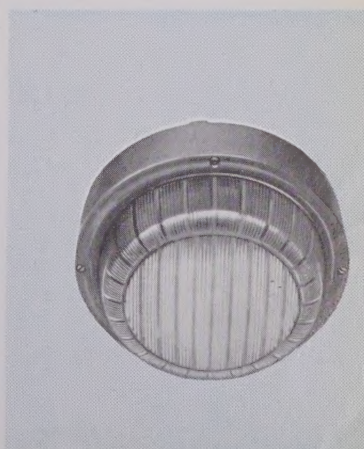
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